FOUNDRY TRADE JOURNAL

Established 1902

Vol. 92 Thursday, May 29, 1952 No. 1865

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PUBLISHED WEEKLY: Single Copy, 9d. By Post 11d. Annual Subscription, Home 40s., Abroad 45s. (Prepaid).

49, Wellington Street, London, W.C.2. 'Phone: Temple Bar 3951 (Private Branch Exchange) Grams: "Zacatecas, Rand, London"

Impressions from France

Last week we paid our annual visit to France to participate in the (25th) Congress of the *Association Technique de Fonderie* and received from the President, Mr. Muguet and his colleagues a really cordial welcome and generous hospitality. We had an opportunity to discuss current affairs with many foundry executives and below we recount some of them. In Belgium, with the exception of the heavy foundries, including the roll-makers, business was fairly slack. In France, however, there is still a good volume of work passing through the shops. Recently, we referred to a model foundry which is being installed in France. This is a purely French enterprise undertaken by the *Centre Technique*, the official opening of which is to take place in the near future.

Naturally we took the opportunity to enquire as to what were the main impressions received by the Ardennes foundrymen during their recent visit to plants in the London district. After all, this was a very important affair, as over 40 participated and constituted probably the largest delegation of French foundrymen so far received in this country. These impressions were (*a*) the tidiness of the British foundries and (*b*) strange to say, the relative newness of the buildings. Some were exercising their minds as to quality of inspection, rejections through scrapping and delivery. If to give an improved delivery, one doubled the inspection staff, the result would be a higher percentage of scrap and a worse "bottleneck" in the despatch department. Was it cheaper, it was asked, to send out a few wasters, than pay away so much money on inspection?

Several French foundries were visited, both officially and unofficially. One was undertaking the task of mechanizing a section housed in a new building and was carrying through the whole project domestically. No doubt this is to give a better spread-over of the capital resources available. It is not a policy we can endorse for this country. The knowledge available to specialist concerns on such items of plant as belt and bucket elevators, moulding machines, ventilation, conveyors, knock-outs, and even roller paths is such as cannot be possessed by any individual foundry. Surely it is best for the cobbler to stick to his last, and, moreover, to-day the manufacture of castings is "some plateful." During one technical session, there was an erudite Paper on the elimination of aluminium from bronze and brass scrap. If, as we suspect, this is sometimes done by French foundries themselves, we suggest that a better policy would be to leave it in the hands of ingot makers, who sell material to specification. There seemed to be a good deal of interest in the shell-moulding process, but probably more work is being done in the U.S.A. and here in Great Britain. Certainly, Mr. Pentz's remarks on the subject seemed to have great interest for his auditors. The technical sessions concluded with the showing by Mr. Bernard Faure, of Revin, of a colour film covering the making of a double-sided matchplate. Foundrymen in the Falkirk area and other centres where light iron castings are made should take steps to borrow this, as it is germane to their type of production.

International Foundry Congress

Final Proceedings

After the closing of the Congress and Exhibition at Atlantic City in the United States, described in our issue on May 15, the international visitors continued their tours of American foundry centres. The "Blue" tour proceeded to Pittsburgh, whilst the "Red" tour travelled to New York and spent two days in visiting foundries in Greater New York and in nearby parts of the State of New Jersey. Both parties travelled to Washington for the week-end May 10 to 11 which was spent partly in sightseeing and partly in discussions. On Monday, May 12, a meeting of all participants was held under the auspices of the M.S.A. Representatives of each country took part in a general discussion on the technical aspects of the plant visits, the Congress and the exhibition. Later in the day both parties returned to New York.

The last day of the official stay in America, Tuesday, May 13, was occupied by making final arrangements for the return journey including the inevitable visit to the revenue authorities. In the evening, the Metropolitan Chapter of the American Foundrymen's Society entertained the whole of the visitors to a reception at the Park Sheraton Hotel. Guests were welcomed by Mr. Dan Polderman, Mr. J. S. Vanick and Mr. J. F. Bauer. The opportunity was taken by the visitors to express thanks to the A.F.S., to the Mutual Security Agency and to all responsible for the Conference and the Exhibition; these thanks were expressed on behalf of the visitors by Commandatore Mario Olivo of Italy. The reply on behalf of the hosts was given by Mr. W. W. Maloney, secretary/treasurer of the A.F.S. who acknowledged the help and co-operation which the Society had received in connection with the planning and organization of this large and comprehensive Congress. The official party left New York on Wednesday, May 14, in the *Queen Mary*. The majority were residents of continental countries and landed at Cherbourg on May 19, whilst the British members of the party landed at Southampton later in the day and early next morning.

In dealing with the pre-Congress and post-Congress tours these notes have referred mainly to the activities of the tour "Red"; tour "Blue" was equally valuable from a technical point of view and its members visited important foundries in Detroit, Buffalo, Chicago and Pittsburgh. This party also received hospitality from the A.F.S. Chapters covering the various cities they visited. From the notes which have appeared in previous issues of the JOURNAL*, it will be seen that the International Foundry Congress consisted of the Congress proper, at which over 100 Papers were read and at which many special discussions took place, the Exhibition, which was probably the largest foundry exhibition ever held, and the pre- and post-congress tours participated in by approximately 100 Europeans who had over 140 foundries to choose from in making their selection of plants to be visited. The Conference and Exhibition was attended by almost 15,000 people.

The task of organizing the Congress was undertaken by the American Foundrymen's Society. Special thanks are due to Mr. W. W. Maloney, secretary, and Mr. Massari, technical director, and to the members of their staff for the vast amount of work they did, frequently under difficult conditions. European participation was largely made possible by the arrangements made by the Organization for European Economic Co-operation in Paris and the arrangements for this participation were carried out by the M.S.A. organization in Washington. All taking part are grateful to the American people for the substantial financial assistance which this co-operation represents.

(*Continued at the foot of column* 2)

Special mention should be made of the work of Mr. John Bolton who was secretary of the party sponsored by O.E.E.C., for which appointment he was loaned by the British Steel Founders' Association. He carried out a vast amount of organizing work and travelled with the "Red" party. (Incidentally, he won a number of prizes in the swimming gala on the *Queen Mary*.) Baron Krayenhoff of Holland was the very successful secretary of the "Blue" tour.

* May 1, 8 and 15.

International Federation of Steel, Tubes and Metal Merchants

The first annual general meeting of the International Federation of Steel, Tubes and Metal Merchants was recently held in Rome and was attended by representatives from Belgium, France, Holland, Italy, Luxemburg, Saar, Switzerland, United Kingdom, and Western Germany. The Federation was formed in December, 1950, and has for its principal objects the co-ordination of the efforts of merchants in all Western European countries to improve the relations between producers and merchants with a view to best satisfying the needs of consumers, and also to facilitate the exchange of information and statistics relating to the steel, tube and metal trades. Useful work has already been done, especially in connection with the Schuman Plan where it has now been established that merchants shall be represented on the consultative committee to the high authority. The British delegation to the meetings in Rome consisted of Mr. J. Annetts, Mr. M. C. Wade and Mr. H. Basil Darby, representing the National Federation of Iron and Steel Merchants, the National Association of Iron and Steel Stockholders and the Steel Distributors' Association. The British steel merchant organizations have not yet applied for membership of the International Federation, but they have, through the National Federation of Iron and Steel Merchants, closely collaborated in its work and have been represented by an observer at all meetings of the executive committee.

Basic Principles of Lubrication

A sound film recently produced for the Esso Petroleum Company, Limited, by Technical & Scientific Films, Limited, gives a clear exposition of the basic principles of lubrication. It is divided into four parts, dealing respectively with friction, fluid-film lubrication, boundary lubrication, and extreme-pressure (or temperature) lubrication. Full use is made of laboratory experiments, micro-photography, animated diagrams and radio-active tracers for metal transference checks. Beginning with an explanation of the elementary laws of friction, the theme is developed in logical sequence, and the film illustrates much of the fundamental research into the behaviour of lubricants and surfaces on which present-day knowledge of this subject is based. Applications for the loan of 16-mm. copies should be made to The Manager, Industrial Sales Department, Esso Petroleum Company, Limited, 36, Queen Anne's Gate, London, S.W.1.

FOLLOWING an all-day meeting on May 23 of the senior staff and senior technical representatives of Foundry Services, Limited, at Nechells, Birmingham, a film show was held. The films shown were the Doëhler Jarvis Company's film "Die Casting," and the Mond Nickel Company's film on precision casting.

Process Planning in the Steel Foundry*

By S. L. Finch.

There is to-day an ever-increasing demand for improvement in the quality of steel castings; not only have the physical properties of steel to pass accepted standards of mechanical tests, but the finished product must be sound, free from defects of all kinds and of good surface appearance. The present Paper outlines the means taken in the steel foundry to achieve high-quality, enhanced productivity from men and materials and to do this repetitively on an economic basis, using what is known as process planning.

The standard of inspection to which a casting is submitted is improving from day to day. Many castings are subject to internal examination by X-ray, gamma-ray, and additionally machining allowances are being reduced. There is a general trend to reduce the sectional thickness of steel castings owing to the good physical properties and quality of alloy steel available. Furthermore, castings that are batch machined or mass produced are frequently jig located and this demands a very accurately-dimensioned job, particularly where the machining allowances are of the order $\frac{1}{8}$ to $\frac{3}{16}$ in. Fig. 1 illustrates an automobile casting which has machining allowances of this order and which is jig located in the machine-shop in large quantities.

The economic manufacture of steel castings is probably as complex a problem as can be found in modern industry. There is little standardization of technique and it is well known that if a group of foundrymen were asked how to make a particular casting, the variance in opinion would be astonishing to anyone not intimately connected with the foundry world. The necessary progressively higher standard of casting is required at a competitive selling price and, obviously therefore, closer control must be exercised over manufacturing methods. Coupled with this, managements have realized that a changing system is overtaking supervisory functions. In pursuing the policy of classifying and separating the distinctive features of production, one of the most fundamental changes has been to divide planning from performance. This also has had the effect of creating a number of functional specialists concerned only with planning manufacturing methods, controlling and recording the results. The object of this Paper is to endeavour to emphasize the importance of one of these sections of manufacture, namely—process planning. This function has not yet been considered to be of sufficient importance in the majority of steel foundries to warrant its existence, whilst in the few that have adopted some system of this type, one of the following procedures is adopted:—

Process Planning

In some foundries, a section commonly known as "Methods" sketches a rough indication of the position of heads, runners, etc., and then, quite frankly, there the matter ends. Sometimes the casting is manufactured by this method, at others small deviations are made, and at times radical changes are adopted, but often without the sanction of the "Methods" personnel. Other systems record the actual finished casting in order that the method may be repeated on future orders. Of what value is this? True, it is better than nothing, but the objective must surely be process planning, not recording a finished article over which little or no control has been exercised.

At this stage, due respect must be paid to all moulding and coreshop personnel, who have mainly in the past controlled all processing. However, in modern industry a foreman must be a person primarily of executive ability possessing a sense of organization combined with the ability to train labour. He must have a broad outlook on production methods and have the ability to absorb changes readily and assist in any new method. It is unjust to ask this person to exercise his technical knowledge in very limited time to produce a casting to the best advantage. Secondly, the plethora of technical development taking place to-day throws a further strain on the speed of evolution of the foreman and it is essential that a system must eventually come into being which will preclude process planning from the foreman's duties.

To be successful, then, process planning must commence at the enquiry stage. On receiving the enquiry the estimating department should be informed of the intended method of manufacture of the casting, equipment required, and suggestions should sometimes be put forward as to the modifications of design to facilitate production. Thus a reasonably correct estimate of cost can be ascertained and the risk of quoting a price wide of actual manufacturing costs be reduced to a minimum.

Immediately an order is received process planning must come into operation as and when the drawing or pattern and core-boxes are available. Before continuing let us examine what should be the prime objectives. These are:—

(1) A sound casting free from dimensional errors;

(2) a casting produced at as economic a figure as possible.

As regards the second objective the following sub-divisions are made in what is considered order of merit:—(*a*) reduction in fettling times; (*b*) moulding

* Paper presented to the Tees-side branch of the Institute of British Foundrymen. The Author is director and works manager of Catton & Company, Limited.

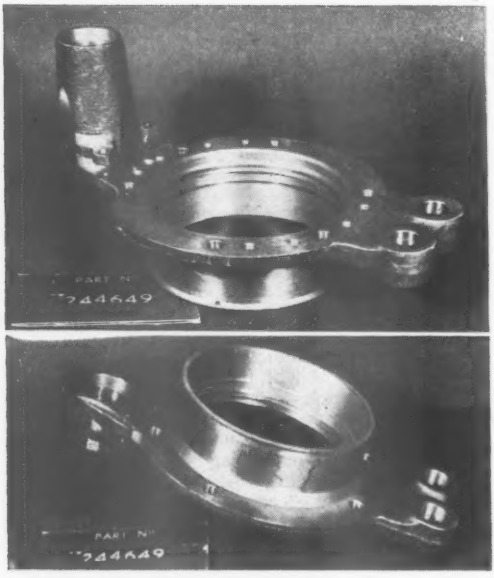


FIG. 1.—*Jig-machined Automobile Casting. Machining Allowances are of the order of* $\frac{1}{4}$ *in.*

cost consideration; (*c*) yield ratio; and (*d*) core-making costs. The process planning department must, therefore, examine the patterns and core-boxes in order that sound castings may be produced, free from internal and surface defects and within casting dimension tolerances.

Manufacturing Methods

The next point must be to examine the manufacturing method so that dressing times are kept at a minimum. For a moment let us consider some unpleasant facts. The majority of steel castings being manufactured to-day are made with very little regard to the dressing operation, yet every executive, manager and foreman knows that the limiting factor of production is the dressing-shop. It therefore is in second order of importance that process planning must consider the cleaning and dressing of a casting. To emphasize this point more clearly, one of the country's leading steel-founders, following upon numerous time-studies, has shown that it requires 0.2 min. to remove and dress each inch of flash, that for an average-size bracket 0.5 min. per inch are required, and where a casting has to be chipped out and welded its total dressing cost is increased by at least 15 per cent. According to the surface quality of the casting, the dressing times were shown to vary as much as 75 per cent. As an instance, a pulley in good surface condition may take 2 hrs. to dress, whereas if the surface is poor this time is extended to $3\frac{1}{2}$ hrs. Once again it cannot be overstressed that the neglect of dressing-shops from this aspect must be remedied in order to obtain higher efficiency. Later in the Paper some practical methods of assisting this will be dealt with.

The method of moulding must be decided once the planning executive has clearly fixed in his mind the above points. Heads and runners are determined, together with the decision whether to make the job from a loose pattern, on a machine, or utilizing other means such as core assembly, always taking into consideration, of course, the economics of manufacture. Coremaking should be studied at this stage and operations be detailed in order that the core can be obtained at the lower cost.

Records.—All this detail must be recorded in a simple way which can be readily understood by all who control each operation. Fig. 2 and Table I illustrate the type of standard method-card issued and first of all this indicates by sketch details of runners and risers, chills, core-irons, etc., required in the manufacture of this item. Instructions are issued on this card as to the method of manufacturing each core. Apart from the effect of process planning on quality control, its impact on production control is considerable. Within a few hours of receiving the pattern equipment, production planning has in its possession facts stating where the job shall be made and how it will be made and special equipment required, etc. This generally leads to more efficient working of the planning system and a large proportion of guesswork is removed.

Personnel. — One immediate question to be answered before enlarging on the system is the personnel required to carry out this work. First, the head of the section or department must possess a certain amount of technical knowledge coupled with a wide experience of manufacturing methods. It is essential that this person has the special aptitude of absorbing technical developments quickly and acquires the faculty of introducing this into process planning in the correct sequence as outlined in the previous paragraphs. His vision must be all-embracing and he must possess initiative to act

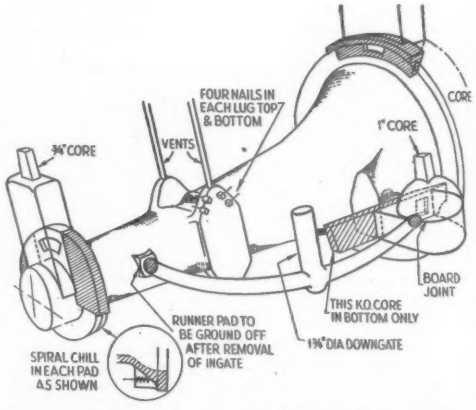

FOUR NAILS IN EACH LUG TOP & BOTTOM
VENTS
¾" CORE
1" CORE
CORE
BOARD JOINT
THIS KO CORE IN BOTTOM ONLY
1¾" DIA DOWNGATE
RUNNER PAD TO BE GROUND OFF AFTER REMOVAL OF INGATE
SPIRAL CHILL IN EACH PAD AS SHOWN

FIG. 2.—*One half of the Standard Method-card showing by Isometric Sketching the Method of Production.*

TABLE I.—*View of a Second Method-card, Illustrating the Order Number Details and other Process Instructions.*

FOUNDRY PROCESS SHEET

P.I. No. 19343

Date 30. 10. 50.

Works Order No.	Item No.	Batch No.	Batch Q'ty.	Date of Issue	Item due date	Dwg. No.	F.M.
02606	1	1	1	19.10.50	End of Nov.	251	1430

Part Name	Mat. Spec.	Pattern No.	Est. Cast Wt. ea.	Est. fin. Wt. ea.	Heat Treatment.
18 in. Cylinder	C.S. 1.	R29/9			920 deg.

Customer BILL JONES P. 37.

Remarks

* The previous method for this job was unsatisfactory owing to secondary shrinkage.

Hand–Machine–Slinger	Area—Flat-Headed
* Hand	
Moulding Boxes	Studs and Chaplets
3 ft. 6 in. round	
Moulding Sand	No. of Cores
Dry	Green Dry 6
Core Sand	No. of Brackets to be cut
Ganister	–
Chills	Test Bar
–	–
Nail Chills	No. of Heads
–	Three

Foreman	Section
McMillan	20 Shop

Cast Weight	Finished Weight	Yield
25·3·20	17 cwt.	63 per cent.

quickly in order that inefficient processes be corrected with the minimum of delay. He need not necessarily be a labour organizer, as his function is purely processing, and here is a fundamental departure from the foreman type. Having established the head of the department, it is essential to give him adequate staff to control efficiently and this depends chiefly on the manufacturing capacity and class of work being produced.

Cost.—The first reaction of all managements is the cost of such a department. The present cost of the process planning department at the Author's foundry is approximately £7,000 per annum. However, breaking this down, one must readily acknowledge that pattern, moulding and core inspection along with tackle making are common to all operations and therefore for pure process planning, the annual expenditure is in the region of £5,000. Ignoring the fact that with such a section, the requirements for supervision in the works are eased, and that general organization is made much more efficient, the fact remains that such a section must eliminate £5,000 from the annual wastage, or increase the efficiency of manufacture or effect a combination of both.

Taking into consideration the average cost figure of the steelfoundry industry, it is probably true to state that the average cost of scrap castings in all stages of manufacture is approximately £80 per ton. This figure is purely an estimate but it is felt that it is a reasonable minimum. Thus in the works referred to, the process planning department has to save 62.5 tons of scrap annually of the 5,500 tons output at least to justify its existence, a saving of about 1.2 per cent. In actual fact, a scrap reduction of 1.50 per cent. has been obtained in the last twelve months, so apart from other financial gains, the implementation of process planning has paid a dividend on scrap reduction alone.

Having thus outlined in general the operations of

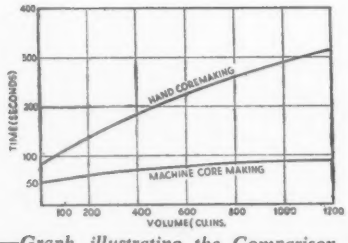


FIG. 3.—*Graph illustrating the Comparison between Machine Coremaking and Hand Coremaking for Similar Cores.*

process planning and digressed a little in order to outline sketchily the cost of such a system, it now becomes necessary to detail the whole system and its effects on each section of the works, ignoring the sales departments—as other factors too complex for the scope of this Paper mask the efforts of processing. The remainder of the Paper is devoted to the implications of process planning on design, pattern equipment, coremaking, heads, runners, sand, etc., and the eventual impact of all this on the dressing shop. It is only intended to dwell on points which will be of general interest and therefore reference to orthodox practice is dealt with as briefly as possible.

Design

In the initial stages of enquiry, and even in the early stages of manufacture, small alterations to design can easily reduce cost, improve productivity and eliminate scrap. One of the jobs of the process-planning section is to deal with these cases at an early date, either in the enquiry or order stage. So often, when castings are returned as scrap, does one hear the story " if only we had such and such a section here," etc. Unless it be a fundamental change in design, it is highly probable that a customer's co-operation can be obtained. Re-design of castings can lead to increased productivity, reduction in cost and elimination of scrap, all to the mutual benefit of customer and manufacturer. Examples of this are commonplace and therefore little reference will be made to these aspects in later paragraphs of the Paper.

Control of machining allowance has become much more important, but there is a danger that the zest of the sales department in obtaining an order may commit the foundry to the impracticable; on the other hand, reduced machining allowance must be considered, and therefore a commonsense balance must be struck between customers' requirements and the condition of manufacture. Often combined with machining allowances are contraction problems which must come within the scope of process planning. Prior to the manufacture of a casting, contraction problems should be considered and necessary corrections made to pattern equipment. The design of a component should be such as to facilitate simple moulding methods and give easy pattern draw. The use of loose-pieces, particularly in quantity production, where castings are jig located for machining, should be avoided and apart from the question of cost, simplicity in design reduces coremaking and will tend to make control of dimensions much easier.

Pattern Equipment

Pattern equipment is most important in foundry production as often it determines the method of manufacture. It would be of great value to the foundry industry as a whole if the customers' enquiry gave a description of the pattern equipment available. If still to be constructed, the customer should be advised by the foundry as to how the pattern should be made. Quite often these precautions are taken, but there are many instances when the pattern has been received in a condition which prevents the cheapest foundry method being used, thus increasing the cost and production time. This results in a difficult situation in the foundry, sometimes it being more economical for the foundry to make a pattern alteration, but in many cases this is not possible and in any event is only a duplication of effort.

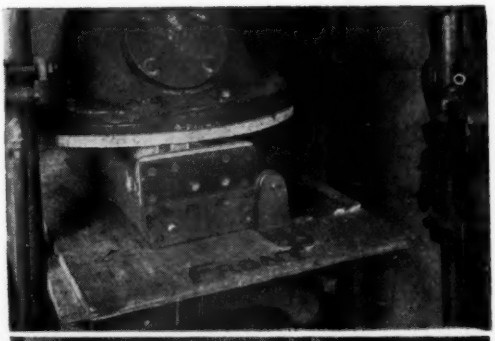
This is a very simple illustration to show how pre-planning and co-operation between producer and consumer will promote a more efficient and economical production. Whilst on the subject of pattern equipment, it may be of interest to point out that location spots for machining should be marked on the drawing, so that the patternshop, foundry-inspection department and machine-shop all work from the same point. This often saves trouble caused by an incorrect pattern allowance in foundry checking. Cases are frequent where iron castings are being changed to steel components, and it is most important that the process planning department has the opportunity to suggest pattern alterations in order that problems of manufacture may be overcome before commencing production.

Coreshop

With the introduction of mechanization into the coreshop, process planning is of extreme importance in the initial stages of planning as it is essential to decide where a core shall be made: (*a*) by hand, (*b*) by machine or (*c*) by core-blower.

Manufacture of Cores by utilizing the Principles of Machine Moulding.—Years ago, the moulding section of the steel foundry was desirous of increasing its productivity. The limiting features of man-power have through these years become progressively pronounced and more and more emphasis has been placed on machine methods of manufacture. These methods have not only increased rates of productivity, but also made available a source of man-power which can be rapidly trained to counteract the gradual decrease of available skilled labour.

At the same time, a similar shortage in skilled labour has taken place in the foundry coreshops. Certain developments such as core-blowing and the utilization of sands possessing high-flowability have made it possible to supplement the waning supply of skilled men with a proportion of semi-skilled personnel. Core-blowing has been introduced, but certain limitations, as yet not fully explored, tend to confine this method of core manufacture to quantity-production lines.



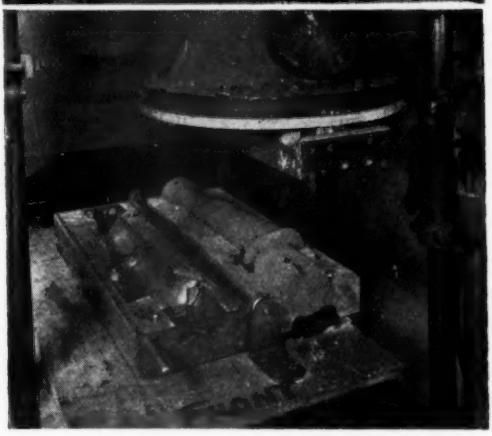


FIG 4 (*left*).—*Method of Assembly of Two Half Core-boxes before Blowing.* FIG. 5 (*top right*).—*Position of Half Core-boxes at the Period of Blowing.* FIG. 6 (*bottom right*).—*Coreblower after the Core has been Blown and Rolled on to an Aluminium Drier.*

It is felt that, if only foundry personnel had attacked the problem in the coreshop in a similar manner to that of the moulding department, much more work would have been done in relation to machine methods of core production. In the Author's foundry, the production of cores by machine moulding methods has been developed. Fig. 3 illustrates a comparison of production times comparing machine coremaking with hand coremaking and it should be pointed out that the quality of core produced has been of a good standard quite equal to that of hand manufacturing methods. One small advantage here is the standard vibration to the core-box on the machine compared to the heavy rapping sometimes used in hand methods, resulting in erratic core dimensions and damaged core-boxes. Another feature of the machine draw is the accuracy with which this takes place; with oil-bonded sands it is difficult to get the "feel" of the draw of the box from the core, often resulting in slight damage which requires patching. With the smooth machine draw, no such damage occurs and so a more accurate core is produced.

With regard to the machine manufacture of cores, the following points can be safely stated:—

(1) The principles of machine moulding can be advantageously adapted to the manufacture of cores.

(2) Productivity rates can be increased considerably by the use of machines, increases ranging up to at least 500 per cent. have been achieved, the rates of increase depending chiefly on size, shape and type of core.

(3) A very wide range of cores can be made by machine methods. Such things as loose-pieces, lightening ashes, grids, etc. do not interfere with machine methods.

(4) Cores of small cubic capacity requiring less than 30 secs. to make can be produced more rapidly by hand. Arbitrary figures, where machine methods are economical in respect of man-power, can only be decided by experience.

(5) Machine operators are able to produce cores of high quality of constant dimensions.

(6) Core-boxes receive no damage during the manufacturing operation and must eventually result in the saving of total man-power.

(7) Fatigue is considerably reduced, as the jarring or squeezing is mechanical and the boxes are rolled over and drawn by similar means.

FIG. 7.—*Another Type of Core produced on the Draw Cylinder Coreblower.*

(8) Machine methods of manufacture are not a panacea for coreshop problems but would appear to have a field of operation filling in the gap between hand coremaking and core-blowing methods.

Coreblowing

It is true to state that the principle and practice of coreblowing have not received the enthusiasm given to the first moulding machines when they were introduced into the foundry industry. Steel casting producers must eventually resort to coreblowing on quite a large scale for two principal reasons (*a*) economics, (*b*) labour shortage. Arguments are put forward that to produce cores cheaply on the coreblower something at least in the region of 500-off is required. This is not so, and indeed the Author's foundry is operating three different types of coreblowers on cores having much less quantities required than normally considered economical for this way of core manufacture. The three methods of coreblowing used are (*a*) the box and container on a horizontal axis, (*b*) on a vertical axis and (*c*) using the bench-type core-blower.

Examples of some of these methods of manufacture are shown in Figs. 4 to 7. Apart from the cheapness and speed of production, a further advantage of coreblowing is that a core produced is of constant dimensions with uniform permeability throughout the core and for each core. How much research has been completed on core-oils and bonds and how many good and probably cheaper mixes have been produced by uneven ramming by the coremaker on prototype cores? It is quite possible for the human element totally to ruin experimental procedure owing to lack of uniform ramming. Production on a coreblower is independent of the human element in this respect and has this further point to recommend it.

The use of the coreblower in the foundry is inevitably linked with the patternshop. Just as the moulding machine must be serviced and fed by the patternmaker, so must the coreblower be provided with suitable core-boxes, adequately vented. One of the most important features of coreblowing is adequate venting, but little guidance can be given here. Practice coupled with experience with each different type of core will, after a little time, give the desired results, and no hard and fast rules can be devised. Sand practice is again a feature of experience as it must be borne in mind that the sand must be sufficiently flowable so as to fill the core-box as it enters under the pressure of the compressor.

Whilst dealing with coreblowing, it should be pointed out that the actual blowing of the core usually occupies between three and six seconds, depending on the capacity of the machine. The main operating time is occupied by handling of the core-boxes and the finished core around the machine and therefore it is quite obvious that to obtain maximum productivity great attention must be paid to material handling. Of course, in the case of the vertical coreblower used by the Author's firm, the fact that the core-box is fastened to the face-plate and the core is blown in the inverted position, eliminates many of the problems usually met when using a heavy core-box (see Figs. 4 to 7).

Several steel foundries are developing coreblowing, and it is felt that in the near future coreblowing will account for quite a proportion of coreshop production and this represents a principle of machine manufacture which, if serviced and operated efficiently, is a further step to help the foundry produce uniform castings of better quality more economically. Once again it is in the direction of deciding how a core shall be made that process planning plays an important part. Immediately on receipt of core-boxes, the job is examined to determine by which method each core shall be manufactured and preliminary preparation work can be executed long before the core-box is required, thus facilitating production planning.

Moulding

Running Technique.—It is probably true to say that in the steel foundry the running of a steel casting has not received the attention it so merits. Efforts have been made to gate a casting in order to obtain directional solidification and quiet entry of metal into the mould cavity. It is not intended here to review the various aspects of gating, but it may be of general interest to outline one or two novel techniques applied by the Author's process-planning department to this point.

Often, in the mounting of a pattern-board, the gating is left to the discretion of the patternmaker and even when a methods sketch is given, the instructions concerning the size of gate are rarely stated. First of all, running speeds must be determined and it is an actual fact that, with the exception of the rule "run as fast as you can, as cold as

you can," no concise statements have been made concerning this vital point.

In order that the foundry may adopt some control over this problem, it is intended first of all to standardize on down-runner size, the actual size at the present time being dictated by trial and error methods. It is not an unusual occurrence for a down-runner of cross-sectional area of, say, 3 sq. in. to be branched off into cross gates and ingates having a total cross-section of at least double that amount. How can this lead to uniform running speeds? In addition, several or all of the ingates may be running at half their capacity, thus producing spalling from the top surface of the ingate and leading to resultant sand trouble.

To overcome this at the Author's foundry, the down-runner areas to be standardized have been divided by 2, 3 and 4 and cross-gates and ingates have been made exactly to the size required. In wood, this entails a quite high production cost. To overcome this, rubber runner material of half-circular cross-section has been purchased in various colours, representing the cross-section areas. Fig. 8 illustrates how simple it is to interpret the method as issued by the process-planning department when coloured rubber runner pattern material is used. Whilst the correct sequence of gating now being followed is far from correct in producing controlled uniform flow, it is true to say that with the existing method there is a firm basis from which, in time, the correct gating technique can be evolved.

One more point of interest whilst on the subject of gating is illustrated in Fig. 9. The process-planning department had found that ordinary methods of step-gating, as shown in Fig. 9(*a*), were unsatisfactory, and although certain suggestions by various research workers were technically correct, they were not too practicable in application. If, however, a down-runner is constructed as shown in Fig. 9(*b*), a correct sequence of running is obtained. Not only does incorrect gating cause scrap as a result of lack of uniformity in metal flow, but, often, extensive metal-penetration is caused by lack of thought. A greater control can be exercised over this problem by studying the gating technique not only by producing uniform metal flow, but also with the thought in mind of avoiding metal penetration.

Heading Techniques.—These have received considerable attention in the last decade and it is only of general interest to quote three of the more recent

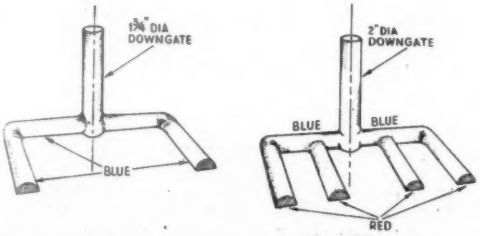


FIG. 8.—*Methods-sketch Indicating the Use of Coloured Runner Material for Gate Patterns.*

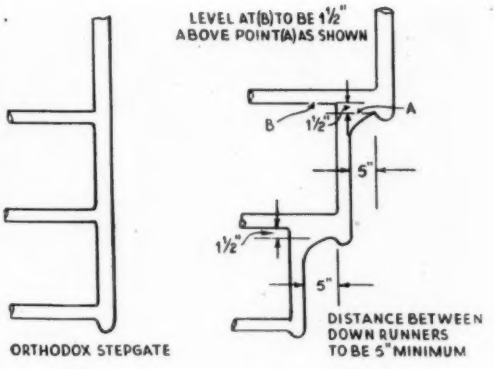


FIG. 9.—*Comparison of Step-gating Methods.*

developments, namely, knock-off heads, the use of insulators and exothermic compounds in the actual head itself. The use of the knock-off heads has received more emphasis in the last two years owing to the visit of the steelfoundry productivity team to the United States. The use of this development can be of great assistance to the dressing-shop. It is not intended to dwell at length on the merits of the knock-off head, but Fig. 10 shows an unusual application of this type of head; the saving of time in the dressing-shop is quite obvious when the new method is compared with the orthodox way of making this casting. A point to note is the use of the square neck—it is claimed that a square neck is much easier to remove than a round neck of the same cross-sectional area.

In the Catton foundry approximately half of the production is dealt with using the knock-off head principle, and naturally in the beginning teething troubles were met, but by persistent application this has been gradually overcome. Apart from the improved costs obtained by the elimination of cutting and reduction in grinding costs, a better flow-

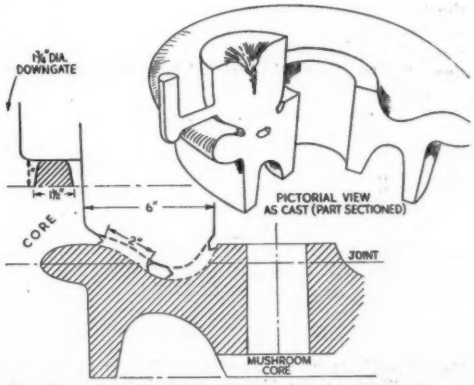


FIG. 10.—*Unusual Application of a Knock-off Head.*

G

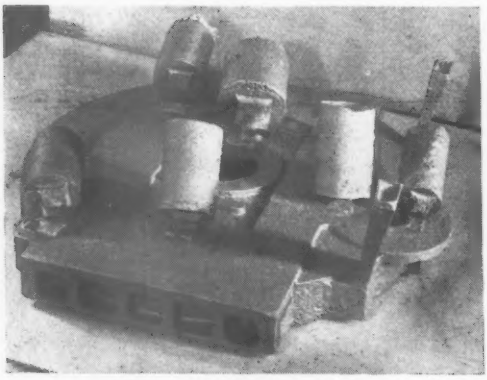


FIG. 11.—*Orthodox Use of the Knock-off Head on an Alloy Steel Casting.*

line of production has been obtained and has eventually resulted in increased output. Fig. 11 illustrates a further use of knock-off heads.

Sleeves and Heater Compounds.—Experimental and in fact production batches of castings have been made using various insulators and exothermic sleeves, surrounding the head-metal reservoir, and at the present time it is safe to say that great improvements in yield figures will be obtained by the utilization of insulators and the use of proprietary materials for this purpose. Much more work is required in this direction, however, before the Author is in a position to publicize the information and also more castings must be produced on a production scale to obtain definite conclusions.

Probably the most interesting development of all has been the introduction of a process developed by K. & L. Steelfounders and Engineers, of Letchworth, embodying the use of an exothermic material which on completion of its reaction produces a superheated liquid steel of a composition very close to that of the casting. Fig. 12 is an indication of what actually occurs in the head metal, the temperature readings being taken by a modified version to the Tinsley immersion apparatus. In the normal head, the temperature dropped from 1,530 deg. C. to approximately 1,525 deg. C. over a

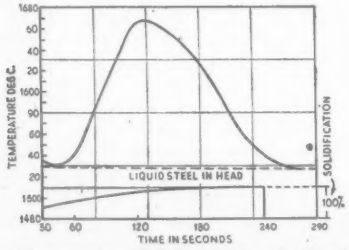


FIG. 12.—*Temperature Readings taken in Feeder-heads to illustrate the Temperature Increment given by using the K. & L. Exothermic Material.*

period of 240 secs., by which time the particular test-piece was completely solid. By the substitution of 80 per cent. of the liquid steel head by 12.5 per cent. of the exothermic material, a curve as shown is produced. After 50 secs. a sudden temperature increment takes place reaching a climax of 1,665 deg. C. after 120 secs. Rather rapid cooling then occurs, but at the final solidification of the test-piece casting there is still a 15 deg. C. superheat. From observations on a production basis, this general degree of superheat occurs in all sizes of heads. Fig. 13 illustrates the comparison between normal and treated heads.

In both gating and feeding, the process planner must use his common sense in order (*a*) to produce a sound casting, and (*b*) reduce dressing operations to a minimum. It is probably in point (*b*) that process planning is superior to the old method of the foreman deciding his own gating and feeding techniques. Once having planned the heading system, the method of moulding is determined largely by the equipment available and the quantity required, and therefore no purpose is served by detailing any particular process or moulding methods.

Sand Control

It is a controversial subject in most foundries as to where the control of sand must lie. This is not a case purely of sand-testing, as obviously this comes within the domain of the laboratory. The control of sand means the manufacture of a moulding material to specifications that suit the particular casting in question. With the present knowledge of moulding materials it is futile in a foundry producing castings ranging from 1 to 10,000 lb. and in quantities of from 1 to 20,000 off to try and run a unit sand.

It must be within the task of the process-planning department to develop or (in the case of larger concerns) insist on having developed, a range of sands both for moulding and coremaking that will free the dressing-shop of much of its burden. As pointed out previously, time-studies have shown that inaccurate control of sands, coupled with their wrong application, alone can increase fettling times by 75 per cent. What a gross wastage of manpower, not freely available to the industry, this is! In all foundries one can find a core-sand that is used in the production of small light castings up to 10 lb. in weight being used (often through lack of information) for heavy-section castings up to 300 times this weight. How can good results be obtained and who is to correct all this? The coreshop foreman is concerned primarily with production from his own section, and in the majority of cases he cannot be expected to know what sand should be used for a particular core. In the process-planning system there is a stage where all core-boxes and patterns are assembled and the process planner at this stage can, by marking the core-boxes in a suitable manner, indicate to the production department which sands shall be used. To many, this may appear laborious and unnecessary, but unless process control is carried out to such fine details, little progress will be made over the whole system.

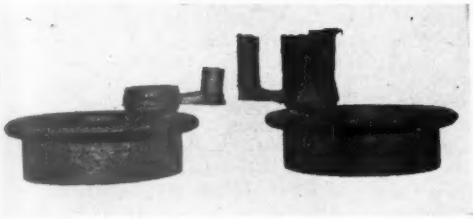


FIG. 13.—*Advantage to be gained in Yield by using the K. & L. Exothermic Material.*

Moulding sands are, of course, to a great degree controlled by the section of the foundry in which the casting is made. There has been a definite trend in mechanized sections to operate on a unit sand but it becomes increasingly obvious that there must be a movement away from this practice and a return to the use of facing sand and backing sand if high-quality castings are to be produced and a reduced amount of correction of defects in the dressing-shop is to be realized. Often it is desirable to increase the labour and material cost in a mechanized section by supplying even more than one type of facing sand for odd jobs of castings that require this, rather than resort to increased dressing in the fettling-shop. Particularly on the jobbing side it is essential to vary moulding materials. In many cases, two or maybe more sands may be used in the facing of the same mould to avoid metal penetration at particular locations. It is much better for the process-planning department to determine this feature rather than leave it to the whims and fancies of an overburdened foreman. Bad gating technique can often result in excessive mould erosion or metal penetration, and many foundrymen have often been involved in bitter argument, one section against another, one blaming sand, another hot metal, and a third poor gating. Confine the problem to one section and there is a greater opportunity of finding the correct solution in the shortest possible time without causing unnecessary friction.

Moulding materials are often considered guilty of causing defects over which they have had no influence but more light is being shed on the subject of metal penetration and one very interesting point was revealed by the method adopted of stack-moulding a simple bush casting. Excessive metal penetration occurred on the lowest casting and was later gradually reduced until it finally disappeared as the top of the stack was approached. Recently, the effect of head height has been shown to have a considerable influence over metal penetration as was shown. It may, therefore, be that the previous remarks on the use of more than one grade of facing sand on deep moulds may be of value in the future as regards increasing the critical pressure at which metal penetration commences.

Constant research and development of moulding materials is so well publicized that to refer to this in detail would result in mere repetition. The Company with which the Author is associated is, in general, following the trend towards the use of finer sands to give an improved surface appearance, and the use of certain special mixtures with resultant reduction in metal penetration. Many of these developments proceed from the process-planning department as it is constantly being pressed on this subject with the object of increasing dressing-shop production.

Casting Temperature

In the Author's foundry, a very wide range of castings is being produced, these varying from heat to heat. Castings as shown in some of the previous illustrations are produced in large quantities with a metal thickness of 0.2 in. and yet it is quite probable that in the next heat of steel from the Tropenas converter heavy-section castings weighing four tons may be produced. More and more importance is being attached to casting temperature. Recent publications have given a lead in this direction and variation in casting temperatures have been shown to have a vital effect on surface finish. There is undoubtedly a critical temperature for pouring a particular casting, but practical working conditions must always be considered. A little thought, however, on the part of those supervising can prevent a very large proportion of metal penetration that is caused because of lack of control of casting temperature. In the foundry being considered, although taking into consideration the range of castings, it has been relatively easy to control pouring temperatures; broadly speaking, the foundry has been split in three sections—(*a*) small castings up to 100 lb. usually with a maximum section of 2 in., (*b*) a section in which the general range is between 60 to 300 lb., and (*c*) over 300 lb.

In addition to having separate sand systems in each unit it has been found that by controlling casting temperatures within a range of plus or minus 10 deg. C. in each section better sand strips with a considerable reduction in metal penetration have been obtained. As an example of the effects of casting temperature on dressing times, manganese-steel track-links cast with ladle metal between 1,600 and 1,630 deg. C. took twice the time to dress as the majority cast with ladle metal between 1,530 and 1,560 deg. C. Thus the steel plant is notified of a temperature range for each particular heat of steel and the basis for measurement is immersion pyrometer readings immediately the liquid steel is poured from the converter to the ladle.

Composition of steel has a marked effect on the critical casting temperature and it has been shown that experimentally in a plain carbon steel an addition of 0.15 per cent. titanium increased the critical casting temperature by approximately 50 deg. C. In the light of these few remarks on casting temperature must be considered (in the designing of a method for a particular casting) a system whereby casting temperature receives full consideration, and should there be any deviation from the general conditions prevailing this should be specified in the card issued by the process-planning section.

Dressing-shop

It should be stated here that the Author suffers from "fettlingitis"—his own term to express the distaste experienced whenever a casting requires

excess fettling owing to bad process planning. An opportunity was granted to the Author to visit two foundries in Belgium where process planning had been in operation for the past 12 years. The quality of castings being produced was far superior to those made in foundries in this country, Europe or the United States and the total annual scrap was under 3 per cent. customers' returns being negligible. To those who have not had the opportunity of seeing, it is to be expected that considerable doubt as to the accuracy of this statement will be expressed. There is no secret as to how these results have been achieved—they are the outcome of process planning. The fundamental reason for this performance is that the casting is *made* in the foundry, not in the dressing-shop. Founders walking through their dressing-shops are recommended to be impartial and assess on ten different castings taken at random how much excessive dressing there is because the job was not *made* in the foundry. Huge lengths of "flash" are cut away in the dressing-shop and no one seems to worry, all because such a loss is difficult to make tangible to the higher executives. It is considered that the dressing-shop is the most neglected portion of the foundry industry and all efforts should be concentrated to offset wastage in this section.

At the commencement, heads and runners can be made easier to remove by the application of the knock-off head. True, this application is not universal, but its field is much wider than generally realized in this country to-day. Actual chipping, of course, can be reduced to a minimum by the close control of sand, gating technique, casting temperature, etc. These points do not receive the attention they warrant unless a process-planning department functions and functions thoroughly. It is not to be expected that the foundry foreman can spend half his working day assessing the waste effort in the fettling-shop and then return to correct this fault. First of all, by process planning, the majority of trouble can be avoided in the initial stages, but at all costs *immediate* corrective treatment must be applied.

To emphasize this wastage of direct labour in the fettling-shop let one consider an analysis of the works (direct-labour only) in man/hours per ton:—

Coreshop	4.93
Machine moulding Loose-pattern moulding	18.29
Dressing-shop	27.93

It is a well-known fact that great efforts have been made throughout the industry in the first three departments to improve productivity by installing modern equipment eliminating waste effort, developing flow-lines, etc. One fact is, however, outstanding, and that is that the total direct-labour in all these departments when added together is still less than the man/hours per ton in the dressing-shop. There is a tendency to turn a blind eye to this fact, and until action such as that recommended by the installation of process planning takes place, little or no reduction in direct-labour per ton will take place.

Scrap Records.—Analysis of scrap records is most beneficial and serves as a useful guide to general policy as well as detailing the scrap on a particular order. Bulk scrap reports over a weekly period should be carefully analysed, and over a period of time it becomes obvious to all concerned where the major weakness lies and suitable action can be taken. Detailed records for a single casting serve a most useful purpose apart from the general action taken on bulk-scrap reports.

Conclusion

In an endeavour to present a contentious subject, the emphasis has been on process planning as an aid to productivity, particularly in the dressing-shop. Once again, too little emphasis has in the past been placed on the low productivity values in this section of the foundry world, and until the right steps are taken to form a casting in the foundry and not in the fettling-shop high productivity values will be unobtainable. Possibly to many it may appear that there is an over elaboration and that the introduction of process planning means an increase in overhead costs and introduction of still more non-productive labour. This is not so, because all the jobs that have been discussed are essential phases in the production of a steel casting, and if a job is to be done let it be well done. It is personal opinion that the foremen of to-day are not in a position to pre-plan the production of the work owing to the complete change in structure of industrial management. It is not intended to belittle the foreman, rather does the introduction of process planning emphasise the fact that a foreman's job is one that necessitates his constant attention to shop-floor problems and is one of organization and supervision rather than of a general factotum.

Sonic Energy Applied to Gas-Cleaning

Pilot-Plant Tests on Open-Hearth Furnace

The application of sonic methods for fume removal from furnace exhaust gas is suggested by C. RICHARD SODERBERG, JR., in *Iron and Steel Engineer*, recently. The Author's firm specializes in the manufacture and application of large-scale mechanical sound generators. He discusses the industrial applications of this sonic equipment and the development required for it to be used on an industrial scale. He explains that sound waves, depending upon their intensity, can transfer energy, bringing about, for instance, the compressing and expanding of a gas. This is carried out in what is known as an agglomeration vessel in which sound waves produced by special machines travel in all directions. An enclosure containing such a random sonic structure is, according to the Author, also termed a reverberant chamber. About 160 decibels is stated to be the sound intensity in a typical chamber of this nature, and will develop a pressure amplitude of 0.283 lb. per sq. in.

Mechanical Charging of Cupolas*

Additional Discussion of Mr. W. J. Driscoll's Paper

At a meeting of the Lancashire branch of the Institute of British Foundrymen, under the presidency of Mr. D. Fleming, a Paper upon the subject of the mechanical charging of cupolas was read by Mr. W. J. Driscoll, at that time development manager to the British Cast Iron Research Association.

The PRESIDENT, in opening the discussion, said that Mr. Driscoll had managed to compress a wealth of valuable information into a very short space of time. The more that information could be considered, the more it would be realized how great an advantage there was in being able to take a proposed scheme to pieces and review it in the light of the Author's remarks.

Vote of Thanks

MR. E. LONGDEN, in proposing that a vote of thanks be accorded to Mr. Driscoll, said the report of his work should certainly be included in the files of every foundry, where it could be consulted in moments of indecision as to whether mechanical aid could be applied to cupola operations. This was seconded by MR. GALE and carried.

MR. TAYLOR remarked that the firm with which he was associated had been operating mechanical chargers since 1921. It had been found that if a hood was fitted on the skip, it was of assistance in the distribution of the charge. A type of charger he had not seen, which was illustrated in the Paper, was one that went straight through the cupola. Could Mr. Driscoll say whether it was satisfactory or otherwise?

MR. DRISCOLL said that distribution was often most difficult to arrange. He was not quite sure what Mr. Taylor meant by fitting a hood to the skip.

MR. TAYLOR replied that it was a deflector, that is, just an ordinary type of hood over the mouth of the bucket so that the charge was thrown more evenly to the centre of the cupola instead of hitting the far wall. His firm had fitted three recently.

MR. DRISCOLL, continuing, said he had not any information about the charger mentioned, which went in at one side and came out at the other. As he had said earlier on in his address, there were plenty of methods about which he had no information. It was to be hoped that in the course of time information might be available about all the various methods so that the industry might have as much knowledge as possible on the whole subject.

MR. LAWSON mentioned that the Paper recalled to his mind a job he had to undertake of installing a mechanized or mechanical loader. At the time, it occurred to him that the question was not so much the type of loader to instal as whether it was the right thing to do to put in a mechanical loader at all. He had been expecting to hear a discussion as to whether mechanical charging was, or was not, better than hand charging.

His firm had put in a charger which was of the skip type with the double, or bifurcated, chute. After much criticism as to the possible lack of good distribution of the charges, it was found that, by gaining about 10 ft. extra height above the original platform, very little trouble was experienced either in respect of metal temperature or in the melting process.

Skip Charging

MR. J. JACKSON recalled certain troubles experienced in respect to mechanical charging in a foundry built some 30 years ago. This was a case of skip charging, and it was decided to protect the top part of the cupola by putting in iron bricks. These were discarded after 12 months' service because there was such expansion that the lining broke away the remaining part of the wall of the cupola. So much expense was incurred that it was found cheaper and better to have the ordinary rammed lining continued up to the charging door. After this experience of damaging the wall, it was decided that the better way was, at the commencement, to load the cupola by hand. After the cupola was full and charges were going down, then very efficient use was made of the mechanical charger.

MR. RENWICK asked how coke was emptied from the railway wagons into the hoppers of the storage bins.

MR. DRISCOLL replied that the normal method of loading hoppers was by means of bottom-opening skips, which might be filled direct from the incoming wagons or trucks, and carried by overhead cranes to the hoppers. The unloading of coke from wagons by means of a grab on an overhead crane, while still practised in the U.S.A., would appear to be undesirable because of the consequent coke breakage. Another method would be to employ a skip hoist, although this, again, might result in appreciable breakage due to the fall of coke from the skip when the hopper was relatively empty. Hoppers were generally loaded by drop-bottom skips. It was his impression, supported by some evidence, that there was very good co-operation between coke suppliers and foundries in the U.S.A. Suppliers would actually ship to foundries coke which was already loaded into drop-bottom skips. If the foundry had an overhead crane, it was only necessary to pick up the skips out of the wagon, and then the coke could be discharged readily into a hopper.

Hand-charging Door Position

MR. CHEYNE noticed that Figs. 8, 10, etc., of the original Paper showed a charging-hole door which was on the same level as the chute. Did Mr. Driscoll prefer it that way, or did he prefer the hand-charging

* Paper printed in the JOURNAL, November 15, 22 and 29, 1951.

door to be lower? Fig. 15 showed a radial inclined bucket hoist. Could Mr. Driscoll explain whereabouts was the winch unit position for hoisting the bucket? It would seem to be the case that the pulley wheel carrying the rope down to the winch unit would have to be inside the cupola. In Fig. 25, the scale and the skip hoist were below ground level. Were factory regulations "easy" with regard to fencing in the U.S.A.?

MR. DRISCOLL said that the supplementary charging door was put in that position on the diagram without very much thought. It was done more or less to draw attention to the fact that a supplementary door could be incorporated rather than to indicate its correct position. Personally, he thought it was preferable for the supplementary door to have its sill to approximate to the expected top of the level of the charges, which would be 2 ft. or so below the sill of the main door, though he did not think it was a very important point. As he had stated previously, the door was mainly used for checking the bed height and for occasional poking. Whether the main sill was lower down did not make very much difference; the necessary adjustment could be made. He could not remember the details with regard to Fig. 15 and the position of the winch, although he thought it would be possible he had some catalogues with him which might give some information. He seemed to remember that the frame carrying the bucket, shown with its end actually inside the cupola, extended along the guides for at least the same distance to the right end of the side-frame of the machine. The pulley lifting the bucket frame need not be inside the cupola. It could be outside the cupola fairly near to the end of the side frames of the machine, but they could check on that later. Regarding Fig. 25 and the arrangement which Mr. Cheyne appeared to think was a little dangerous, he must admit quite frankly he had not seen such an arrangement, and he did not think he had seen a photograph of one. That point had never occurred to him; admittedly, it was one which required to be borne in mind.

MR. E. LONGDEN had not expected that in the welter of information which had been made available, Mr. Driscoll would have missed yet another means of charging a cupola, namely, a mobile electrical charger. He remembered seeing them in the U.S.A. in 1926, and they were still being used. The charger bucket proceeded to the charging platform and automatically charged the cupola. There seemed to be quite a deal of doubt as to whether the coke was weighed or measured out. The amount of moisture that coke might hold was a deterrent in deciding that weighing was the correct course to take. It could be assumed that the larger the cupola, the more accurate the charges would be, since the amount of difference between a plus or minus weight would be relatively smaller.

MR. DRISCOLL assumed that the mobile electrical charger mentioned operated from a platform.

MR. E. LONGDEN said it was operated from ground level. It was charged there and proceeded up to a hoist and discharged to the cupola.

MR. DRISCOLL thought it would go up to a platform in the sense of a goods lift, or something like that.

MR. LONGDEN replied that it did.

MR. DRISCOLL remarked that he had had that form of charger in mind, but he had regarded it as what might be termed a mechanical aid on a conventional charging platform. He had tried to concentrate on hoists or chargers which were more or less self-contained, and lifted the bucket or skip from ground level into the cupola in what was virtually one movement. He agreed that it was somewhat difficult to lay down definitions, but, in his own mind, he had rather excluded that type of mechanical charging from the Paper. He had, in fact, mentioned it under a small section he had written at the end, in respect to what he had called "mechanical aids on charging platforms."

MR. E. LONGDEN mentioned that the Ford Company, at Detroit, with their cupolas, had an excellent means of conveying material to the platforms, but it was hand-charged to the furnaces.

Linings

MR. J. JACKSON asked what particular type of lining the American foundries used for their cupolas.

MR. DRISCOLL said American conditions were very similar to those which obtained in this country. Brick linings and rammed linings were probably used in much the same proportions. One which the Americans used, and which we were not able to use in this country, was what was termed silica firestone. This was a stone of high-purity silica which was found in a natural state, and could be conveniently split into shapes suitable for furnace linings. Such a lining was understood to have very good properties, but it was not used universally.

MR. SOUTHERN referred to the use of iron bricks in the cupolas, thus preventing the abrasion of the lining by the material being charged. In use it was frequently found that the firebrick which was encased inside the iron brick, or surrounded it in some fashion, tended to separate from the rest of the brickwork. Was there any danger of the charges sticking on the ledges in that case?

MR. DRISCOLL admitted that he had not gone into any great detail with respect to the design and arrangement of iron-brick linings. His impression was that they were not normally encased. Iron bricks did not normally encase or surround firebricks, except in so far as the bottom layer of iron bricks was adjacent to the firebricks underneath it. He might be wrong, but he had never noticed any occasions where ledges were formed on iron bricks which were sufficiently serious as to result in scaffolding.

In further reply to Mr. Taylor, Mr. Driscoll agreed that care must be exercised in the case of large pieces of scrap which should be broken down sufficiently in order to enable them to flow through the charging system without getting stuck.

Conference Works Visits

This year, Sheffield is the centre for the works visits arranged in connection with the annual conference of the Institute of British Foundrymen, June 10 to 13. Visits of parties of delegates travelling from the conference headquarters at Buxton will be made to three foundries in the morning of Friday, June 13, and five in the afternoon. Brief descriptions of a number of these works are printed here to give advance indication of the types of foundries which are to be inspected and the sort of work carried on. For many of the larger establishments, it should be borne in mind that the foundry is but one section of an integrated engineering works and the productions should be assessed accordingly.

FIG. 1.—*Photograph of a 90-ton Rolling-mill Casting at English Steel Corporation Limited, indicative of the Heavy Foundry Industry of the Sheffield Area.*

STEEL FOUNDRY OF ENGLISH STEEL CORPORATION LIMITED

English Steel Corporation, Limited, was formed in 1929 by the amalgamation of the steel interests of Vickers Armstrongs, Limited, and Cammell Laird & Company, Limited. The Corporation has various works in Sheffield, Manchester and Darlington, and is the largest alloy and special steel producer in the British Commonwealth. The steel foundry at Grimesthorpe Works, Sheffield, which will be visited by the Institute, is one of the largest and most modern in Great Britain, and produces castings from a few lb. to 150 tons in weight.

At Grimesthorpe it has been normal for many years to study American and Continental methods and to collaborate with foreign firms. It is therefore not surprising that plant and practice resemble closely those recommended in the report of the Anglo-American steel foundry productivity team. Owing to the wide variations, both in size and quantity, of castings produced, the layout of the foundry is quite out of the ordinary. To cope with this range of products in the most efficient manner the foundry is divided into light, medium and heavy departments, and each department is again subdivided into smaller self-contained sections, according to the type of moulding employed, *viz.*: (1) green-sand, mass-production moulding; (2) skin-dried, mass-production; (3) specialized jobbing work; and (4) heavy pit and floor work.

Mechanized and Heavy Production

The green-sand mass-production section has three units with self-contained sand plants and adjacent electric-arc melting furnaces. The moulding equipment for the units are (*a*) four jolt-squeeze, pattern-draw machines suitable for boxes up to 18 by 21 in.; (*b*) four jolt, roll-over machines capable of handling boxes up to 3 ft. 6 in. square; and (*c*) a Sandslinger unit for green-sand castings up to a weight of about 30 cwt. Backing sand for one of these units is obtained from an American "Speedmuller" which can mill 15 cub. ft. of sand every 90 secs. The "medium" foundry makes a range, mainly of jobbing castings, up to about 10 tons in weight.

Heavy Castings.—A specially-equipped section of the foundry does all the pit and floor work for castings weighing up to 150 tons and this section can now be said to be the most up-to-date in the country. New casting pits up to 25 ft. deep, and some 64 ft. long, have been made and special 2-ton capacity wall-type creeper cranes have been installed solely for servicing, coring and the lighter work required by the moulders. Molten steel for this section is obtained from three Siemens acid, open-hearth furnaces which permit the casting at one time of 180 tons of liquid steel. Fig. 2 shows the moulding of a large rolling-mill casting and in the heading block (Fig. 1), the pouring of this mould is illustrated.

Ancillary Departments

Core production is divided into two sections, one for heavy and the other for light cores. Most of the heavy core work is done by hand, and the same sand is used as for the heavy moulds. For the smaller cores, the recent completion of an additional separate mechanized section has doubled the size and output of plant.

Considerable reorganization of the heat-treatment and fettling departments has taken place. In addition to ensuring more efficient and economic operation, these changes have enabled the

FIG. 2.—*Making a Mould for a* 90*-ton Rolling-mill Housing at the Heavy Foundry of English Steel Corporation Limited.* (*Fig.* 1 *shows the Teeming of this Casting.*)

segregation of heat-treatment and shot-blasting from the fettling shops and foundry bays. Heat-treatment furnaces are of modern type, and include very large sizes for the heavy bulky castings. Burning-off and shot-blasting are also carried out in the same section. A two-chamber Wheelabrator machine, with a 19-ft. dia. table has been in use for some time, and another double-table machine has just started up. Other new plant on order for cleaning and fettling heavy work will include a two-gun Hydroblast plant for large castings.

FIG. 3.—*Light Fettling Bay at English Steel Corporation Foundry, showing the Examination of Railway-wagon Bogie Side-frame Castings.*

Fettling is done in three separate shops according to the weight and types of product. New designs of swing-frame grinders, incorporating dust-extraction, are in use. Two bays of one shop are devoted to the fettling of castings for railway bogies, see Fig. 3, whilst another section deals specially with rear axle casings for motor lorries, which are moved along on a suspension monorail. Another section specializes on the assembly of automatic railway couplers.

Although most castings are despatched unmachined, machining of certain types of large castings is done if required, and the Corporation has machine-shops equipped with plant for the heaviest castings made. Before despatch, all castings undergo either visual, gauge, or "marking-off" inspection.

EDGAR ALLEN & COMPANY, LIMITED

The Edgar Allen business in Sheffield was founded in the year 1868 by the late Mr. William Edgar Allen, and along with dealing for a number of years with a general merchant trade, it also concentrated on the manufacture of tool-steel and files. Mr. Allen sold a very large proportion of these products to foreign buyers and acquired a

high reputation for these specialities in Italy, Spain, Portugal, and other countries. Subsequently, he purchased the old-established premises and business of Hoole, Staniforth & Company, whose experience in the manufacture of similar products was already extensive. In the year 1890, Mr. Allen was joined by Mr. Robert Woodward, and the late Mr. Alfred E. Walls, and in 1892 by Mr. F. A. Warlow, and the firm was converted into a limited liability company under the present title. In 1891, the business was transferred to the present situation, on the south-east side of the road from Sheffield to Rotherham, at Tinsley. The works then rapidly expanded; a steel foundry was put into operation and one of its earliest results was the successful production of steel castings for dynamo magnets which, up to that time, had been made of wrought iron. The firm took over, in 1903, the business of Askham Brothers & Wilson, Limited, Yorkshire Steel & Engineering Works, Sheffield, a name well known in connection with tramway trackwork generally, as well as with conveyors, ore-crushers, disintegrators, air-separators, etc. The acquisition of this business ensured for Edgar Allen an outlet for their Imperial manganese-steel for tramway work and the various component parts of crushing and grinding machinery, which have to withstand heavy wear. In 1939, the business of the British "Rema" Manufacturing Company, Limited, originally located in Halifax, was acquired and the works and staff transferred to Sheffield. This subsidiary company manufactures kiln-firing plant, disintegrators, food-mixers, crushing and grinding machinery, etc.

Present Lay-out

The older part of the works is bounded by the road from Sheffield to Rotherham, and by the Sheffield and South Yorkshire canal. The newer portion is on the opposite, north-west side of the road and was commenced by the transfer of the Askham plant referred to earlier; it has been gradually built up on a prearranged plan and comprises two large steel foundries, one of which is shown in Fig. 5. What may be styled a third portion of the plant has been built since the war and is located to the south-west of the older works, on land fronting Shepcote Lane.

FIG. 4.—*Use of Oxygen in Electric Furnace at the Works of Edgar Allen & Company, Limited.*

The premises now cover an area of about 43 acres, and between two and three thousand are employed, including staff. The products of the Company include steel castings up to a finished weight of 15 tons, tool steels, stainless and heat-resisting steels, permanent magnet steels and

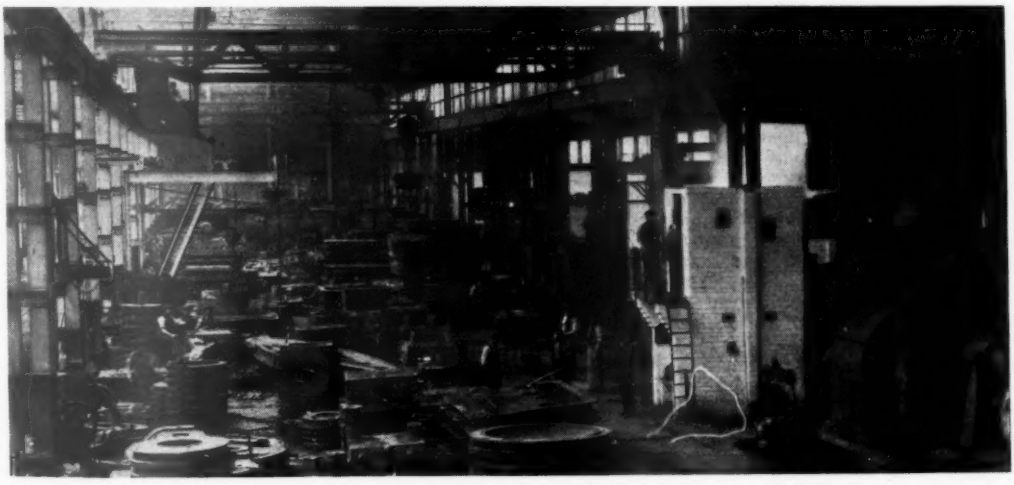


FIG. 5.—*General View of the Steel Foundry at Edgar Allen & Company, Limited.*

FIG. 6.—*Patternshop at the David Brown Foundries Company, Penistone.*

finished magnets, railway and tramway special trackwork in ordinary and Imperial manganese-steel, cement-making plant, lime-making plant, crushing and grinding machinery, and a wide range of small tools for engineering use, such as butt-welded tools, tungsten-carbide tools, deposit-welded tools, twist drills, circular saws, cutters and reamers, and the like. The melting plants employed include high-frequency electric crucible furnaces, Héroult electric-arc cupolas (see Fig. 4), Tropenas converters and cupolas. The company has adequate canteen facilities, a large sports ground, a works lecture room, excellently-fitted-up and well-staffed ambulance rooms, and many other amenities.

DAVID BROWN FOUNDRIES COMPANY

Established in 1937 as part of a major expansion within the David Brown organization, the David Brown Foundries Company stands on what was formerly a derelict site of 29 acres at Penistone, a small township 12 miles south-east of Huddersfield. The foundries are designed on modern lines, and are well-equipped both in personnel and plant for the production of alloy and carbon steels and bronze castings. During the development of the site, full advantage has been taken of the opportunities to introduce equipment laid out on the most efficient lines, and to-day these foundries are regarded as being among the finest of their type.

A progressive policy and scientific approach to the problems of steel and bronze castings has been maintained, and a large proportion of major technical developments introduced into British foundry practice during the last decade has been incorporated by the Company. Among these can be included such examples as inspection by X-ray, gamma-ray and isotopes, vertical-axis centrifugal casting, cement-sand moulding, cast armour for fighting vehicles and high-tensile steel castings for many types of civil and military aircraft.

Oil-field Equipment

One of the most notable post-war achievements by the David Brown concern has been its contribution to the successful effort made by British engineers, foundrymen and manufacturers to enter the

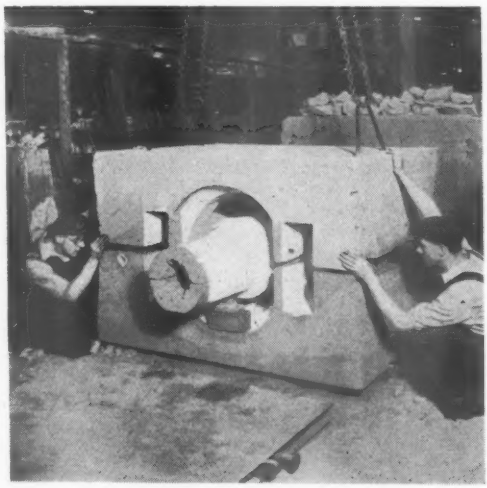


FIG. 7.—*Closing a Cement-sand Mould in the Main Steel Foundry of the David Brown Group.*

FIG. 8.—*General View of the Main Steel Foundry at the David Brown Foundries Company, Penistone.*

specialized production of oil-field and oil-refinery equipment, hitherto an American monopoly. Profiting by their rapid technical advances made during the war in the production of alloy steels, the Company has succeeded insomuch that at the present time approximately one-third of the Penistone steel foundry's production is being exclusively devoted to this type of work.

Products of the David Brown Foundries Company are world renowned and find application in many parts of the world, for such purposes as stator end-plates (in non-magnetic steel), rotor-hubs for large alternators, turbine cases and miscellaneous equipment. Pressure castings are incorporated in oil-field pumps, valves and pipeline components, steel and bronze castings for pumps, and heat-resisting castings for gas turbines. Precision castings (made by the investment process), nickel castings for commercial-vehicle rear-axles and for worm-reduction-gear units, and bronze castings for slip-rings are other typical examples of the foundries' activities.

During the visit of the delegation of the Institute of Foundrymen to these works, the departments and processes to be inspected include the patternshop; coreshop; floor moulding; arc furnace; large shot-blasting plant; light fettling; heavy fettling; green-sand moulding; high-frequency furnaces; centrifugal casting of steel; machine moulding; the bronze foundry; machine-shop; and laboratory. Fig. 6 shows the patternshop; Fig. 7 illustrates the closing of a cement-sand mould in the main steel foundry. Fig. 8 is a general view of the main foundry, a feature is the storage-rack accommodation for the cement-sand mould parts.

(*To be continued*)

Respect for Existing Contracts

As a result of balance of payments difficulties many governments have introduced measures of various kinds, such as the annulment of import or export licences, and various other interferences with trade. A recent meeting of the commission on commercial and monetary policy of the International Chamber of Commerce, at the instance of the British National Committee, deplored action on the part of governments, when annulling import or export restrictions, that ignored the existence of contracts already legitimately entered into between their own and other nationals. The commission felt that the repudiation of contracts which must follow such action by governments inevitably created hesitation on the part of traders to enter into commitments, and international trade was seriously affected. While recognizing that governments were frequently compelled by events to take unpremeditated action, it was considered that ways could be found of ensuring that legitimate contracts were respected.

Brazilian Iron Ore

The government-controlled Cia. Vale do Rio Dôce, S.A., Brazil, which mines, transports, and exports iron ore from the Itabira deposits in Minas Gerais, continued to make excellent progress in 1951. The annual report states that 1,314,000 metric tons of iron ore were mined, compared with 732,000 tons in 1950. The 1951 profits of the E.F. Vitória a Minas rose to $Cr31,000,000 against $Cr5,500,000 in 1950. The principal products transported last year included 1,400,000 metric tons of iron ore, 127,000 tons of timber, and 55,000 tons of charcoal. Exports of iron ore have increased from 35,000 long tons, valued at $U.S.189,600, in 1942, to 1,274,000 tons ($U.S.12,600,000) in 1951.

LIEUT.-COLONEL K. G. MAXWELL, manager of the publicity department of Metropolitan-Vickers Electrical Company, Limited, Manchester, has retired from executive duties after 41 years' service with the Company. He will continue to act in an advisory capacity. He is succeeded by MR. E. E. WALKER, assistant manager of the department since 1945.

Publications Recevied

Resolite 400. Published by the Technical Service Department of Aero Research, Limited, Duxford, Cambridge.

This is an eight-page, nicely-illustrated pamphlet dealing with a proprietary core-binder of the newer synthetic-resin type. It deals with the subject of stickiness, core-blower application and incorporates a series of pictures furnished by Alfred Herbert, Limited, showing the practice followed in their foundry for the production of cores for heavy castings and further examples taken from a light iron castings foundry in Lancashire. As this subject of resin core-binders is much in the limelight at the moment, founders will no doubt be interested in writing to Cambridge for a copy.

King George VI and Industry—A Tribute. Published by the Industrial Welfare Society, Robert Hyde House, 48, Bryanston Square, London, W.1.

A king's duties have many facets, most of which find their place in history, yet in this pamphlet there is recapitulated a sovereign's devotion to the betterment of the position of the men and women engaged in industry. This in the ordinary way would not "break into the headlines," yet the activities disclosed represent a great service to industry and the country. No better source of information could be drawn upon than that available to the publishers, for the Industrial Welfare Association was the organization which sponsored King George VI's visits to works. During the tours around the shops, his intelligent interest in manufacturing processes and especially in the people who handled them, animated all those whom he met with that sense of service to the community, which was the mainspring of his great reign. The brochure very graciously describes and illustrates a Royal activity well meriting a permanent record.

Bibliographical Survey of German and Japanese Experience in the Extraction of Low-grade Non-ferrous Ores and the Recovery of Non- ferrous Metals and Compounds (Report No. RSM-3). Published for the Department of Scientific and Industrial Research by H.M. Stationery Office, York House, Kingsway, London, W.C.2. Price 3s. 6d. net.

This is an up-to-date, 100-page survey of all published British and American official reports on German and Japanese extraction and recovery methods on low-grade non-ferrous ores and metals respectively. Upwards of 500 references are given, which include individual reports and summaries previously published in review form. The survey is divided into six main sections—(1) mining, ore-dressing and statistics; (2) smelting, refining and recovery of (seven) base metals; (3) production and recovery of light metals; (4) production and recovery of titanium, manganese and metals of the fifth and sixth groups; (5) production and recovery of precious and rare-earth metals; (6) production and recovery of selenium. In addition, there are four appendices—I. Documents and reports held by T.I.D.U. relating to non-ferrous ore deposits; II. Production of non-ferrous metals in mercury cells and the extraction of pyrites cinders; III. U.S. Government reports held by T.I.D.U. relating to the extraction and recovery of non-ferrous metals; IV. List of libraries holding reports. Under each of the main headings is given first of all the now familiar FD, B.I.O.S., FDX, F.I.A.T. etc. report number, followed by the title, the price of the report and a précis of the contents.

W. G. M.

Magnesite Mould-washes

Mr. S. G. Urane, foreman, Broken Hill Proprietary, Limited, Melbourne, Australia, writing in the February issue of the *American Foundryman*, states that satisfactory results have been obtained over a number of years with the substitution of finely-ground magnesite for silica-flour in three foundry applications. As a result of experiments carried out with various materials not containing free silica, magnesite has totally replaced silica-flour as a general core- and mould-wash, and in reducing the permeability of core and mould facing sand.

Iron-free magnesite is calcined at about 1,630 C. Calcined magnesite of percentage composition, SiO_2, 5.35; Al_2O_3, 1.31; Fe_2O_3, 0.55; CaO, 3.42; MgO, 84.97; and ignition loss 4.57; is charged dry into a ball-mill where it is ground for eight hours to give the desired fineness of at least 80 to 90 per cent. through 200-mesh sieve.

Wash composition.—The core- and mould-wash is made of 85 lb. calcined magnesite flour, 1¼ lb. core-gum or dextrin, and 3¼ lb. Western bentonite. These ingredients are first mixed dry to distribute the bentonite, which prevents clotting, and then placed in an air-agitated mixer where water is added to give a hydrometer reading of 62 Twaddell (34 Baumé). The wash keeps in suspension well, it is easy to apply, and successive coatings can be applied without fear of spalling either in the drying of the mould or during casting.

Application of the wash varies according to the type of mould. For general castings, the core or mould face to be painted is first roughened by rubbing with a piece of burlap, and then skin-dried to allow the wash to soak in and thus close up the spaces between the sand grains on the face.

The first coat should be slightly thinner than the succeeding coats in order for it to soak in. Time should be allowed between each coat for it to become air-dried. A gas flame may be used if desired. It may be practical to paint the moulds after drying and whilst still warm enough to dry the wash. Two applications are usually enough, but successive coats may be added at the discretion of the moulder.

A second use detailed is in loam moulding and a third for reducing the permeability of facing sand.

House Organs

Carron Cupola. Vol. 3, No. 2. Issued by the Carron Company, Falkirk.

In this issue there are some noteworthy photographic reproductions and some interesting details of the life and work of the Adams brothers.

Albion Works Bulletin, Vol. 6, No. 3. Issued by John Harper & Sons, Albion Works, Willenhall.

This issue, which is more than ordinarily interesting, carries a report of the trip to Canada made by the export manager, Mr. Norman Williams. Increased attention is being given to accident prevention and a fresh committee is being formed. The Poole foundry is making good progress. Recent researches have shown the foundry was in existence in June, 1628, and that there is a connection between the site of the foundry and "Robinson Crusoe."

ROOSTER PUBLICITY, LIMITED, is arranging to send a mobile photography unit to India and Pakistan for the purpose of obtaining illustrations of British plant, machinery, and capital goods.

Graduate Course in Metallurgy

A graduate course in metallurgy which is part of a national scheme to maintain a supply of men fitted for technical positions of major responsibility in industry is announced by the Department of Industrial Metallurgy, University of Birmingham. The course provides a year's training in industrial metallurgy at a post-graduate level for men who hold degrees in metallurgy, physics, chemistry, or engineering and who are already engaged in, or proposing to enter, the metallurgical industry. Lectures and tutorial classes deal with the following:—(1) *Industrial Metallurgy*: Technical, economic and organizational factors influencing costs of production; (2) *Structural Metallurgy*: Physical metallurgy and its application to technically important processes (3) *Principles of Refining, Melting and Casting*: Thermodynamics of metal-gas and metal-slag reactions; heat and liquid flow; (4) *Principles of Working of Metals, Heat Treatment and Welding*: Theory of deformation of metals and its application to industrial metal working processes; thermal treatment and joining processes; (5) *Modern Laboratory Techniques*: X-ray crystallography; non-destructive testing; strain gauges; instrumentation of plant. Extensive use is made of the seminar system in which students present Papers for discussion on selected topics in industrial metallurgy. Practical work is carried out principally with the full-scale manufacturing plant in the new Aitchison Laboratories. The course includes studies in metallurgical works of problems arising in industrial production. The inclusive fee for the graduate course in metallurgy is £71 1s. Further details and forms of application may be obtained from the Registrar, The University, Edgbaston, Birmingham, 15.

Germany Retains More Scrap

The supply of scrap on the German home market has recently shown a considerable easing. Deliveries of bought scrap to blast furnaces and steelworks totalled 3.600,000 metric tons in 1951, a monthly average of 300,000 metric tons. In the first quarter of 1952 deliveries to blast furnaces and steelworks amounted to some 1,120,000 metric tons, a monthly average of 373,000 metric tons. Receipts of scrap by foundries were at a monthly average of 107,000 metric tons in the first quarter of 1952, compared with a monthly average of 104,000 for the whole of 1951.

Exports of scrap have shown a marked decline. During 1951 an average of about 60,000 metric tons of scrap a month was exported. For the first quarter of 1952, exports were at a monthly rate of only 29,440 metric tons. These exports are being continued under Government order.

Blast-furnaces and steelworks have been able to rebuild their stocks, which had been run down during the course of 1951 from 488.000 metric tons to 213,000 metric tons. By the end of March, 1952, stocks of scrap at blast-furnaces and steelworks had risen to 326,000 metric tons.

KING ISLAND SCHEELITE, the Australian Company which mines the scheelite deposit on King Island in Bass Strait, between Victoria and Tasmania, is to instal new plant at a cost of £A300,000. The Company's output is disposed of under long-term contracts with the British and U.S. Governments. According to a statement by the Company's chairman, another boring operation is to start this year to prove the deposit to the west of the known ore bodies.

Parliamentary

Scrap Supplies

The average weekly deliveries to blast furnaces of destructor scrap during each of the six months ended March, 1952 (with the corresponding figures for the previous year in parentheses) were:—October, 1951, 2,100 (2,600) tons; November, 1951, 1,900 (1,800) tons; December, 1951, 2,000 (2,300) tons; January, 1952, 2,100 (same) tons; February, 1952, 2,300 (same) tons; March, 1952, 2,300 (2,100) tons.

Giving this information, MR. DUNCAN SANDYS, Minister of Supply, told MR. G. R. STRAUSS that it was not practicable to maintain complete records of domestic scrap collections.

Asked by MAJOR BEAMISH whether he was aware that some scrap dealers were offering very low prices for scrap collected in the countryside, and if he would now give wider publicity to the methods being used to collect scrap in country districts and ensure that a correct price was being paid for it, the MINISTER said that he was not aware of it. He said he would arrange for cases of alleged underpayment to be investigated if Major Beamish could give him the necessary details. Widely-publicized schemes which provided for farmers to be paid a fair price for their scrap were being operated satisfactorily in several counties, with the full support of the National Farmers' Union, he added.

Light-castings Industry

Asked by MR. M. MACPHERSON whether he was aware that there was widespread short-time working in the light-castings industry, and whether he would take steps to ensure that sufficient materials were available, and orders placed, to enable this industry to work a full week, the MINISTER OF SUPPLY said that he understood that short-time working in certain iron-foundries producing light castings was due mainly to the loss of export markets. He was not aware that there was a lack of orders in the home market for most of the light castings which Mr. MacPherson had in mind.

The MINISTER OF FUEL AND POWER told Mr. MacPherson that allocations of coke, as between the iron-foundry industry and the steel industry, was normally made on the basis of full consumption requirements, with provision for stockbuilding in the summer and for stocklifting in the winter.

Iron-ore Imports

Imports of iron ore in April and the total for the first four months of the year, with comparative figures for 1951, are shown below.

Country of origin.	Month ended April 30.		Four months ended April 30.	
	1951.	1952.	1951.	1952.
	Tons.	Tons.	Tons.	Tons.
Sierra Leone	30,900	83,980	149,340	278,184
Canada	—	—	—	32,088
Other Commonwealth countries and the Irish Republic ..	2,906	1,249	7,997	7,369
Sweden	258,188	357,621	957,949	1,152,065
Netherlands	895	420	4,095	2,418
France	28,883	43,989	134,543	147,794
Spain	61,287	56,255	262,468	224,826
Algeria	71,010	164,727	377,853	597,534
Tunis	49,846	39,196	158,220	154,941
Spanish ports in North Africa	28,600	43,330	122,140	126,834
Morocco	15,758	32,650	78,068	107,380
Other foreign countries	7,464	52,111	27,325	113,498
TOTAL ..	555,737	875,528	2,279,998	2,944,931

Imports and Exports of Iron and Steel in April

The following tables, based on Board of Trade returns, give figures (in tons) of imports and exports of iron and steel in April. Figures for the same month in 1951 are given for the purposes of comparison and totals for the first four months of 1952 and of 1951 are also included.

Exports of Iron and Steel

Destination.	Month ended April 30.		4 mths. ended Apr. 30.	
	1951.	1952.	1951.	1952.
Channel Islands	604	563	2,584	2,323
Gibraltar	97	128	221	338
Malta and Gozo	228	144	870	653
Cyprus	454	554	1,680	1,461
Sierra Leone	283	540	895	1,900
Gold Coast	2,018	4,093	6,338	12,509
Nigeria	5,046	2,246	19,698	15,646
Union of South Africa	19,429	12,270	48,478	49,858
Northern Rhodesia	1,685	2,095	5,757	9,691
Southern Rhodesia	3,707	4,344	10,796	16,301
Tanganyika	1,618	1,239	6,474	7,630
Kenya	4,405	3,502	20,516	15,690
Uganda	410	556	1,751	3,017
Mauritius	1,205	761	2,664	1,867
Bahrein, Qatar, and Trucial Oman	355	{ 1,475 }	2,756	{ 5,807 }
Kuwait		{ 1,200 }		{ 6,967 }
India	10,137	9,140	34,623	25,059
Pakistan	8,041	6,394	30,901	24,660
Malaya	6,581	8,059	24,090	27,429
Ceylon	3,427	2,271	10,749	7,924
North Borneo	209	144	974	1,035
Hongkong	5,025	1,959	23,023	5,763
Australia	33,205	26,464	129,094	121,140
New Zealand	14,172	12,620	48,433	45,466
Canada	27,721	15,342	76,316	58,836
Jamaica	1,763	1,596	5,103	8,793
Trinidad	4,729	2,456	11,464	15,331
British Guiana	445	539	1,775	1,718
Anglo-Egyptian Sudan	1,140	1,526	3,417	4,989
Other Commonwealth	2,732	1,502	7,928	8,985
Irish Republic	8,514	4,400	30,758	21,565
Soviet Union	165	36	1,650	37
Finland	2,536	4,838	13,439	23,057
Sweden	10,103	9,149	33,318	37,235
Norway	7,644	5,246	23,811	21,402
Iceland	185	676	788	1,085
Denmark	8,340	6,743	32,957	32,073
Poland	11	18	380	50
Germany	72	110	418	511
Netherlands	8,998	7,727	31,272	31,011
Belgium	1,150	622	4,879	2,815
France	266	186	3,356	918
Switzerland	906	757	3,989	2,944
Portugal	2,263	691	7,070	3,245
Spain	657	623	1,549	1,678
Italy	3,462	1,230	7,565	5,956
Austria	37	32	173	160
Yugoslavia	2,534	55	4,700	2,337
Greece	396	249	1,142	1,409
Turkey	458	604	1,293	2,889
Netherlands Antilles	336	358	1,180	4,030
Belgian Congo	130	309	611	1,173
Angola	142	65	793	1,894
Portuguese E. Africa	527	595	1,392	1,465
Canary Islands	121	10	450	372
Syria	13	185	488	729
Lebanon	2,453	1,437	5,550	5,660
Israel	2,138	1,010	8,897	5,566
Egypt	4,124	2,742	14,018	12,029
Morocco	17	14	1,255	100
Saudi Arabia	39	401	116	2,041
Iraq	1,675	4,316	8,303	16,626
Iran	7,541	901	29,438	4,332
Burma	1,138	1,323	4,754	4,519
Thailand	1,591	891	5,872	3,066
Indonesia	544	1,145	2,196	4,800
China	597	8	4,074	8
Philippine Republic	85	215	1,287	1,593
U.S.A.	20,987	2,897	75,154	17,394
Cuba	564	110	1,913	718
Colombia	361	391	2,863	2,096
Venezuela	4,190	3,178	11,158	16,973
Ecuador	113	214	351	1,618
Peru	1,319	635	3,946	3,396
Chile	1,152	583	4,067	1,542
Brazil	1,724	3,440	7,854	8,317
Uruguay	1,591	626	6,795	2,398
Argentina	6,921	4,577	19,847	14,352
Other foreign	2,021	1,943	7,147	7,155
TOTAL	283,722	204,233	975,644	842,025

Total Imports of Iron and Steel

From	Month ended April 30.		Four months ended April 30.	
	1951.	1952.	1951.	1952.
India	—	111	1	155
Canada	2,628	8,685	14,511	22,921
Other Commonwealth countries and the Irish Republic	95	404	444	1,591
Sweden	2,063	2,086	6,881	9,434
Norway	5,165	6,046	16,175	23,213
Germany	1,587	7,899	5,174	32,199
Netherlands	2,792	10,233	15,510	44,528
Belgium	12,468	25,711	40,832	93,671
Luxemburg	5,404	6,120	27,132	45,142
France	15,745	13,471	80,570	83,878
Austria	4,881	3,882	4,952	24,033
U.S.A.	3,198	69,463	13,624	132,167
Other foreign countries	141	13,780	625	45,043
TOTAL	56,167	167,891	226,431	557,975
Iron and steel scrap and waste, fit only for the recovery of metal	55,847	46,982	249,912	160,866

Total Export of Iron and Steel

Product.	Month ended April 30.		Four months ended April 30.	
	1951.	1952.	1951.	1952.
Pig-iron	2,415	181	10,049	1,122
Ferro-tungsten	36	26	217	75
Other ferro-alloys	91	316	986	1,426
Ingots, blooms, billets, and slabs	688	3	3,621	78
Iron bars and rods	1,145	416	3,458	1,326
Sheet and tinplate bars and wire rods	308	70	4,710	443
Bright steel bars	3,402	913	15,741	4,396
Alloy steel bars and rods	1,768	1,600	5,672	5,340
Other steel bars and rods	21,663	7,863	83,299	37,244
Angles, shapes, and sections	18,892	9,132	70,203	44,854
Castings and forgings	923	723	3,434	4,003
Girders, beams, joists, and pillars (rolled)	4,554	2,840	14,858	12,302
Hoop and strip	5,553	4,874	23,822	18,077
Iron plates and sheets	264	88	723	190
Tinplate	21,194	28,404	86,853	99,454
Tinned sheets	368	133	1,055	464
Ternplates and decorated tinplates	54	81	424	315
Other steel plate (⅛ in. thick and over)	28,539	16,551	100,304	77,369
Galvanized sheets	5,803	5,503	22,885	21,658
Black sheets	14,671	11,632	49,228	46,297
Other coated plates and sheets	991	1,146	3,064	4,022
Cast-iron pipes up to 6 in dia.	7,872	6,721	23,895	30,049
Do., over 6 in. dia.	8,214	6,021	23,568	22,198
Wrought-iron tubes	44,804	32,450	131,235	144,245
Railway material	28,009	18,093	84,875	69,475
Wire	6,700	4,608	23,767	18,719
Cable and rope	2,863	2,648	10,082	9,843
Wire nails, etc.	3,714	840	10,858	3,886
Other nails, tacks, etc.	500	468	1,450	1,798
Rivets and washers	635	531	2,250	2,125
Wood screws	293	392	1,254	1,497
Bolts, nuts, and metal screws	2,737	2,233	9,511	9,121
Baths	1,208	1,811	4,512	7,040
Anchors, etc.	868	958	2,999	3,624
Chains, etc.	1,066	1,048	3,529	3,825
Springs	530	568	2,052	2,091
Holloware	2,320	2,000	7,298	8,290
Doors and windows	1,928	1,694	6,164	7,189
TOTAL, including other manufactures not listed above	283,722	204,233	975,644	848,025

Personal

DR. J. I. CARSWELL, lecturer in the department of engineering at Edinburgh University, will retire from that post in September.

MR. D. H. WILLEY has relinquished his post at the Ministry of Defence to join the B.S.A. group research centre at Greystones Hall, Sheffield.

MR. NORMAN HENCKEL, assistant manager for five years with the Mercantile Dry Dock Company, Limited, Jarrow-on-Tyne, has been appointed a surveyor with Lloyd's Register of Shipping.

COUNCILLOR FRANK H. GRAINGER has been appointed chairman of Ripley Urban Council. He is a draughtsman employed at G. C. Ogle & Sons, Limited, engineers and ironfounders, Ripley, near Derby.

MR. D. A. STEWART has been appointed consulting civil engineer, with particular reference to concrete design and testing, to Sandberg's, consulting and inspecting engineers, of London, S.W.1.

MR. CHARLES PARRY, manager of the Templeton Coke Works of the Consett Iron Company, Limited (Co. Durham), has received a presentation on his retirement after 50 years' service with the Company.

MR. R. H. BRUFF has been appointed sales manager, mechanical handling equipment, of the Yale & Towne Manufacturing Company, Willenhall (Staffs), in succession to MR. A. A. SIMPSON, who has resigned.

AT THE END of June, DR. H. HOLLINGS is to relinquish his appointments as director of the London research station of the Gas Council and as controller of research with the North Thames Gas Board. DR. R. H. GRIFFITH has been chosen to succeed him in both appointments.

MR. J. A. MONKS has been appointed managing director of Electric Furnace Company, Limited, of Weybridge, jointly with MR. D. F. CAMPBELL and MR. W. S. GIFFORD. MR. W. J. MILLAR has been appointed managing director of the EFCO Engineering Company, Limited, Burton-on-Trent.

MAJOR JACKSON MILLAR, C.B.E., and MR. HUGH W. FULTON, who for more than five years were directors of Albion Motors, Limited, Glasgow, have joined the Board of Leyland Motors, Limited. Mr. Fulton has just returned from a trip to South Africa, where he completed a survey on behalf of both Companies.

ON HIS last day in office as Lord Mayor of Sheffield, MR. T. W. BRIDGLAND opened the new canteen at the Templeborough works of the Steel, Peech & Tozer branch of the United Steel Companies, Limited. Last week he returned to the canteen to work in his capacity as canteen manager.

MR. W. G. TUCKER, foundry superintendent, I.C.I., Limited, Metals Division, Witton, has been elected president of the Birmingham Metallurgical Society for the coming year. The four vice-presidents who have been elected by the council are Mr. J. O. Hitchcock, Mr. G. Parkin, Dr. C. E. Homer and Mr. H. Evans, while Mr. A. C. Craig becomes honorary treasurer.

THREE NEW APPOINTMENTS have been made at district offices of Metropolitan-Vickers Electrical Company, Limited, dating from April 1: MR. E. MEAD, B.Sc. (Eng.) Lond., M.I.E.E., was appointed as assistant manager of the London office; MR. R. ALLEN, Assoc. M.C.T., A.M.I.E.E., as assistant manager of the Birmingham office; and MR. T. GILL, B.Sc., A.M.I.E.E., as manager of the Swansea sub-office.

MR. RONALD E. WICHMAN, managing director of Fergusson, Wild & Company, Limited, iron ore and mineral merchants, of London, E.C.3, has resigned his position with the Company as from July 1, in order to take up residence abroad. MR. GUY FALLA has been appointed to the Board, and will assume the managing directorship upon Mr. Wichman's departure. MR. J. O. H. DAWSON has also joined the Board.

MR. CHARLES RAMSDEN, overseas director of the Federation of British Industries, has retired after thirty-three years' service. With the F.B.I., he has taken a leading part in building up the present world-wide organization of the overseas services. He is succeeded by MR. PETER TENNANT who, before he joined the Foreign Service, was a Fellow of Queens' College, Cambridge, and College lecturer in modern languages and University lecturer in Scandinavian languages.

FOLLOWING the relinquishment by Commander Sir Robert Micklem of all his various offices in the Vickers group of companies and his subsequent death on May 13, Vickers-Armstrongs, Limited, has appointed SIR JAMES REID YOUNG as chairman, MAJOR-GENERAL C. A. L. DUNPHIE as managing director, engineering works and shipyards, and E. J. WADDINGTON as director of administration. All three are already directors of the Company. MAJOR SIR HEW KILNER continues as deputy chairman and managing director, aviation.

MR. H. G. HERRINGTON has been promoted to managing director of High Duty Alloys Limited, Slough, Bucks, a member Company of the Hawker Siddeley Group. He has been general manager since 1930 and was appointed a director of the Company in 1937. He is also on the Boards of Aluminium Wire & Cable Company, Limited, Northern Steel Scaffolding and Engineering Company, Limited, Société des Alliages legers de haute Resistance and is president of the Council of the Aluminium Development Association.

SIR PATRICK GEORGE HAMILTON, who has recently been appointed an additional director of the Renold & Coventry Chain Company, Limited, Manchester, is chairman of Henry Simon, Limited, flour, oatmeal and provender milling engineers, etc., of Stockport (Cheshire), and of several of the Company's associates. He is a director of Simon-Carves, Limited, coke-oven plant manufacturers, etc., of Stockport, and of Expanded Metal Company, Limited, London, S.W.1. From 1943 to 1944 he held the post of director of propellor production at the Ministry of Aircraft Production.

Less Steel Produced in Luxemburg

Owing to the damping down of a blast furnace for repair, iron and steel production in Luxemburg fell slightly in March. Pig-iron production was 267,752 metric tons, compared with 270,416 metric tons in February, crude steel output being 260,456 metric tons, against 264,640 metric tons.

The average monthly production of pig-iron in the first quarter of 1952 was 270,060 metric tons, against 248,129 metric tons in the corresponding period in 1951. Steel output was at a monthly average of 263,800 metric tons in the first quarter of this year, compared with 263,651 metric tons in the first quarter of last year.

TWO STEEL GIRDERS weighing 92 tons each, which were sent by road from Shropshire, have arrived at the works of the Consett Iron Company, Limited (Co. Durham), where they are to be used as overhead crane girders. The girders were carried on two lorries, travelling at about 5 m.p.h., the journey lasting several days.

News in Brief

OVER 20,000 TONS OF SCRAP are said to be rusting away on bombed sites in Sheffield.

PRODUCTION of steel ingots and castings in the Sheffield area in April averaged 41,700 tons a week.

WM. WADSWORTH & SONS, LIMITED, have had plans drawn up to extend their foundry off High Street, Bolton.

AN OUTBREAK of fire at Longfield Foundry, Parkinson Lane, Halifax, on May 19, destroyed a quantity of timber but production was unaffected.

SOUTHERN FOUNDRIES (1926), LIMITED, have had plans prepared for the erection of new offices and a bath house at 512, Purley Way, Croydon, Surrey.

SWAN, HUNTER & WIGHAM RICHARDSON, LIMITED, Wallsend-on-Tyne, has obtained an order from Greek owners for a 11,000-ton cargo motorship.

AN ADMIRALTY CONTRACT worth £1,500,000 for a new type of Diesel engine for use in small warships has been secured by Ruston & Hornsby, Limited, Lincoln.

ABOUT 70 MOULDERS employed by Dobbie, Forbes & Company, Limited, Larbert Iron Works, came out on strike on May 19 following a shop meeting on rejected castings. The men returned to work on May 21 unconditionally.

FORTY MEMBERS of the Derby Society of Engineers visited the Stanton Ironworks, near Ilkeston, on May 22. They made a tour of the works under the guidance of Mr. W. S. Matthews, training officer to the Stanton Ironworks Company, Limited.

OWING TO some recession of work, and as a temporary measure only, the gravity-die departments of the Birmingham Aluminium Casting Company, Limited, one of the associates of the Birmid Group, are working a four-day week as from May 12.

A MODERNIZATION SCHEME designed to double the output of the company's fabricating shed is expected to be completed by the end of this year by R. & W. Hawthorn, Leslie & Company, Limited, marine engineers, shipbuilders, etc., of Newcastle-upon-Tyne.

AN ORDER for a 10,200-ton cargo ship for delivery in 1956 has been received by Short Bros., Limited, Sunderland, from the Thomasson Shipping Company, Limited, London. One vessel already on order for the Company is expected to be delivered next year.

IT IS EXPECTED that many people will visit the works of Hadfields, Limited, Sheffield, next month, on the Company's "at home" days on June 10, 11, 12, 17, and 18. Employees and friends will be shown round the works under technical guidance.

A LONDON FIRM have demolished a cast-iron flywheel, 25-ft. dia., 10 in. wide and 16 in. thick. It was part of a 75-year-old steam engine, which was installed at the Royal Crown Derby Porcelain Works, Osmaston Road, Derby, in 1877, and was in use until 1940.

THE NEW GATES for the reconstructed and enlarged dry dock of T. W. Greenwell & Company, Limited, shiprepairers, of Sunderland, will be floated into position on June 1. Reconstruction of the dock, which was damaged by enemy action during the war, has taken two years. It will be able to accommodate vessels of 32,000 tons.

THE WORKS of Plews & Turner, Limited, textile engineers and ironfounders, of Elland (Yorks), was severely damaged by fire recently. Almost the whole range of the company's wood patterns was destroyed, and two buildings were nearly ruined. Production has been slowed up, but has not stopped. The damage is estimated at £3,500.

PAINT RESIDUE in a ventilator shaft at the premises of the Keighley Fan and Motor Company, Limited, Keighley, was ignited by sparks from an oxy-acetylene welder on May 20. The fire was tackled by workmen at the factory, who were joined by others from a nearby textile mill. One workman was slightly burned on the forehead while fighting the blaze. The damage was estimated at less than £100.

HOPE that the Australian import bans would be modified "within a few weeks" to allow standing contracts with Britain to be honoured, was expressed by the Agent-General for New South Wales, Mr. J. M. Tully, when he addressed members of the Birmingham Rotary Club on May 19. Mr. Tully said that Australia urgently needed the locomotives, rolling stock and other heavy equipment which is on order in Britain.

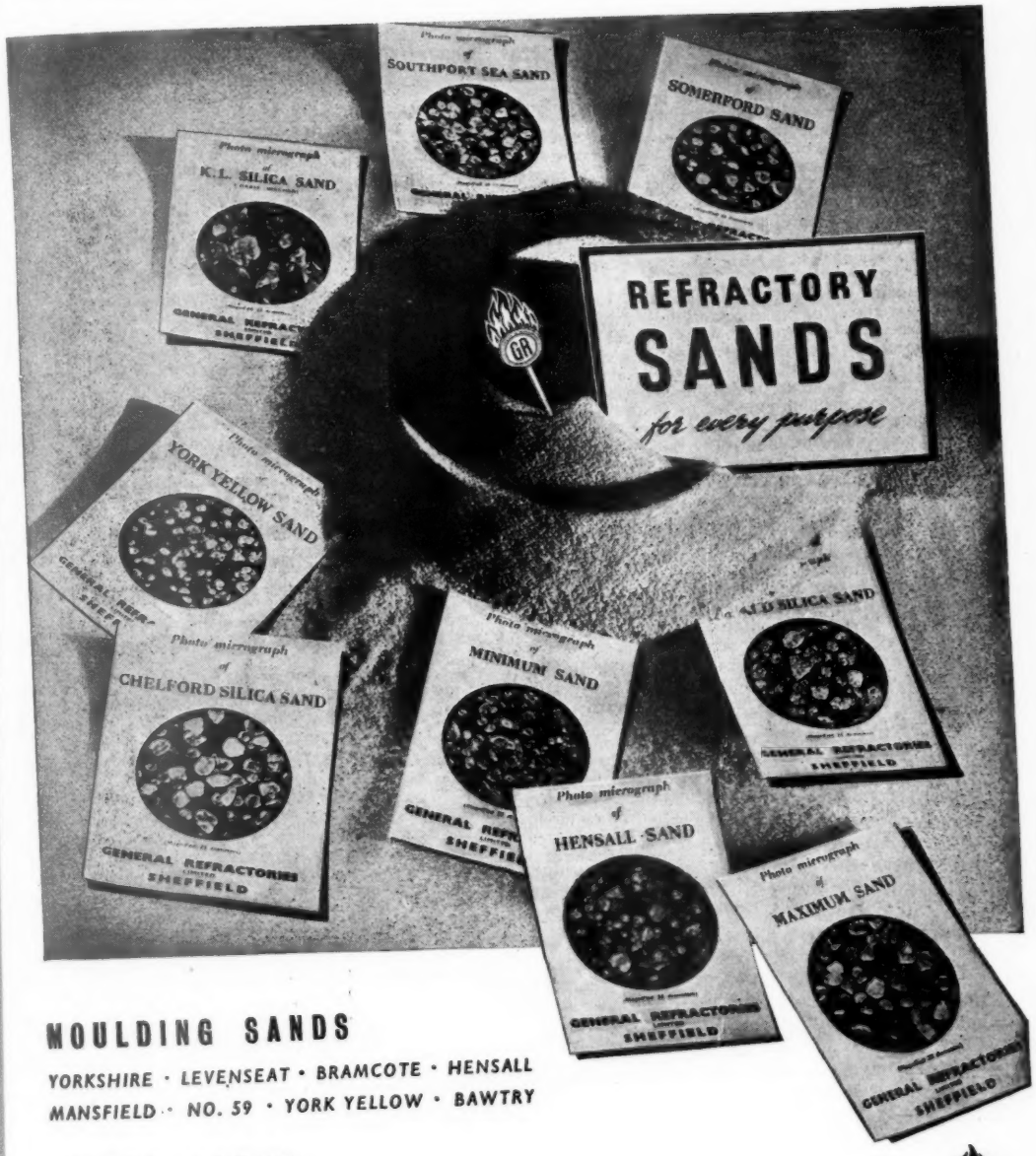
DISCUSSIONS ON trading arrangements for the year 1952 in accordance with the Anglo-Yugoslav Trade Agreement, 1949, have been successfully concluded in London. These arrangements provide for the import into the United Kingdom from Yugoslavia of non-ferrous metals, miscellaneous goods, and foodstuffs. Exports from the United Kingdom to Yugoslavia include agricultural, mining, electrical, and other types of machinery.

ACCORDING to what was stated at a meeting of Ayr Works Committee of the Town Council recently, the new foundry premises contemplated by James Dickie & Company (Drop Forgings), Limited, in Seaforth Road, Ayr, will be quite substantial. The Committee had had under discussion the question of the extension of the roadway; it was noted that the total cost would be £4,650, and that the supplying and laying of a 6-in. water pipe would involve expenditure of £300.

BIRMINGHAM, which for years has claimed to be the home of the famous Soho Foundry of Boulton & Watt, has at last conceded to Smethwick the honour which is its due. *The Midlands of England*, published last week by the city's information department, says this of Smethwick: "The famous Soho Foundry, opened by Boulton & Watt in 1796, was in Smethwick, to the north-west of Birmingham. To-day, greatly enlarged, the foundry produces world-renowned scales and weighing machines."

TWO WALSALL MEN, who admitted receiving 3,000 stolen sacks worth £375, over a period of a few months, were each sent to prison for three months by Tipton magistrates on May 20. Mr. Frank Cooper, prosecuting, said the proceedings followed the conviction at Tipton on April 8 of a lorry driver who had stolen large quantities of the sacks from his employers, the Duport Foundries, Limited, Tipton. Mr. Cooper said the case illustrated to a remarkable extent the wave of dishonesty that seems to be sweeping through all classes of the community. The sacks were used as containers for castings and were worth 2s. 6d. each.

NEW MANUFACTURING APPOINTMENTS at Associated Electrical Industries, Limited, and Metropolitan-Vickers Electrical Company, Limited, are announced as from May 15:—Mr. Walter Symes has resigned from the board of Metropolitan-Vickers Electrical Company, Limited, and from being works manager at the Trafford Park works in order to take up the appointment of manufacturing consultant, Associated Electrical Industries, Limited. He will be available to all the A.E.I. group Companies to advise on general manufacturing problems. Mr. Arthur C. Main, assistant works manager, M-V Trafford Park works, has been appointed works manager in succession to Mr. Symes and has been elected a director of the Metropolitan-Vickers Company.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Raw Material Markets

Iron and Steel

Some foundries connected with the textile industry are reported to be not so well employed as they have been, but apart from these the majority of other types of foundries have good order-books, and their demands for raw materials, particularly pig-iron and scrap, exceed available supplies. Pig-iron production is well maintained from the furnaces in blast, the additional supplies having been very helpful to consumers, particularly to the steelmakers whose operations have depended on increased supplies of basic pig-iron owing to the continued shortage of scrap.

In the main, the foundries are short of supplies of their normal grades of pig-iron, and those available frequently have to be accepted with unusual analyses. The engineering and speciality foundries are chiefly affected. Hematite, although still very stringent in supply, is difficult to secure in normal analyses. Outputs of the low- and medium-phosphorus grades are much below requirements.

The jobbing and light foundries are favourably placed, and there is a continuous request from many of them for an increase in their present allocation of high-phosphoric pig-iron. In practically every instance these have to be refused as production is not sufficient to permit of increased deliveries.

No easing in the position can be expected so long as demand and supply remain at the present levels, unless more furnaces are put into blast. This can be accomplished only as soon as sufficient blast-furnace coke can be obtained to blow in the units now ready and those in prospect.

Scrap for the foundries is scarce, and light scrap has to be acquired to make up the shortage of heavy cast-iron material. Foundry coke is coming forward regularly, but there is little to spare after current consumption is satisfied. Ganister, limestone, and firebricks are available to meet requirements.

The suspension of orders from some oversea markets has not affected the working of the re-rollers. Deliveries of semis from the Continent are small and uncertain, and the dispute in the American steel industry is causing apprehension in regard to deliveries from that source. Meanwhile, the majority of the re-rollers continue on short time. The sheet re-rollers are heavily engaged, but their programme is retarded owing to the shortage of sheet bars.

The position as regards production of finished iron is becoming more critical due to the reduced output of forge pig-iron and the increasing difficulty being experienced in the collection of suitable scrap.

Non-ferrous Metals

Last week saw the long-awaited reduction in the price of zinc, not as a result of any fall in the U.S. quotation, but in line with the Government's avowed intention of maintaining U.K. metal values on an even keel with world prices. In practice this means a sterling quotation based on the E. and M.J. price converted at $2.80, plus a margin, £10 or £11, to cover cost of ocean freight, insurance, interest, and delivery to consumers' works.

While manufacturers will welcome this change of policy, which resulted last week in a reduction of no less than £24 in the zinc quotation, they will continue to hope for a return to free market conditions under which in pre-war days we bought our zinc and lead below the U.S. parity and our copper at the rough equivalent of the American f.a.s. price.

It is satisfactory that the Government has again announced its intention of returning all commodities to free enterprise as soon as the balance of trade situation permits. Lead too came down last week, by £2 only it is true, to £129. As a result of the sharp fall in the zinc price, permitted maximum quotations under the control order will be brought down in proportion, the expectation being that 60/40 mixtures will lose £10 and 70/30 £7 per ton.

Considerable interest attaches to the copper position in the United States where the Government has announced a let-up on price limits on domestic copper products. This means that fabricators may now buy foreign copper at the higher world levels and this may well offset the decline in imports from Chile. It is, of course, possible that the Chilean producers will find buyers in the United States who are willing to pay a price acceptable to the somewhat exalted ideas of the Chilean Government. A figure of 33 cents has been mentioned, and even 35 cents.

On the other hand, the President's action in releasing 22,000 short tons of copper from the U.S. stockpile may well put a brake on any exhuberance of that kind and lead the Chileans to a conviction that they have little hope in the near future of disposing of their copper above 27½ cents. Certainly indications are not lacking that the sharp edge of demand for copper in the world has been somewhat blunted. But we are probably a long way yet from any fall in the American copper price.

London Metal Exchange official tin quotations were as follow:—

Cash—Thursday, £954 to £955; Friday, £966 to £967; Monday, £968 to £975; Tuesday, £969 to £971; Wednesday, £970 to £972.

Three Months—Thursday, £947 to £947 10s.; Friday, £954 10s. to £955; Monday, £957 to £958; Tuesday, £958 to £958 10s.; Wednesday, £959 to £959 10s.

Notes from the Branches

Tees-side Branch

The "Tees-side branch" of the Institute of British Foundrymen, formerly known as the "Middlesbrough branch," held their annual general meeting on April 4. The new officers for the 1952-53 season were elected and the following are the appointments made:—

As *branch president*, Mr. E. W. Dowson; as *senior vice-president*, Mr. Gordon Brand; as *junior vice-president*, Mr. C. H. Wilson; as *honorary secretary*, Mr. Frank Shepherd; as *branch representatives to General Council*, Mr. J. K. Smithson and Mr. C. H. Wilson; as *Technical Council representative*, Mr. L. Johnson; and as *reception officer*, Mr. Hood.

The following members were elected to the Branch Council:—Mr. Vickers, Mr. Riley, Mr. Owston, Mr. Humphries and Mr. Adamson. An enthusiastic vote of thanks was given to Mr. H. Marshall for the valuable services rendered during his year of office and a very hearty welcome was made to Mr. Dowson, the new president.

After the meeting, a lecture on "Loam and Dry Sand Moulding" was given by Mr. D. Redfern, of South Shields. Mr. Redfern's Paper was very well received indeed and aroused great interest among the large number of members who attended. There were some excellent slides shown of difficult and intricate moulds which had been made under Mr. Redfern's supervision. It was evident that the lecturer was able to draw on vast practical experience to meet the many problems of foundry moulding. The meeting closed with a hearty vote of thanks from the branch, proposed by Mr. Foster.